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ABSTRACT

This paper reviews the background and key terminology of the Internet, its current scope and use, and a selection of public policy issues. "Chapter 1: What Is the Internet?" includes an overview; capsule history; explanation of how the Internet works; basic terminology; and the kinds of information available on the Internet. "Chapter 2: Commerce on the Internet" discusses general requirements of electronic commerce; digital signatures; online payment systems; taxation and the Internet; business and professional licensure and certification; competition with local businesses; trademark and domain name disputes; antitrust issues; telecommunications regulation; impact on the phone system; online commerce risks from power failures; and policy options. "Chapter 3: Government on the Internet" gives and overview of federal, California state, and local government uses of the Internet and selects some sites for purposes of illustration. "Chapter 4: Libraries and Education on the Internet" discusses issues related to new media; libraries, schools and colleges on the Internet; lifelong learning; and policy options. "Chapter 5: Privacy, Freedom of Speech, and Internet Abuse" outlines issues of personal privacy; freedom of speech; risks to children and adults from materials and activities online; Internet data security risks; and types of misuse and abuse. "Chapter 6: Improving Access to the Internet" looks at some of the barriers to access and some ways of improving access. (Bibliography includes 44 listings. A glossary defines selected terms and refers readers to dictionaries. Concludes summary of sites illustrating the myriad types of private-sector online services and information.) (DLS)

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THE INTERNET: A CALIFORNIA POLICY PERSPECTIVE

Prepared at the request of
Assemblywoman Elaine White Alquist
Representing the Silicon Valley

By

Kenneth W. Umbach, Ph.D.

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Digest

The Internet, an international network of computer networks, began as a federal government initiative in the 1960s, but has now become a predominantly private and increasingly commercial system. Use of the Internet is rising exponentially, with no sign yet of leveling off. Growth over the last few years has been fueled by the rise of value-added, consumer-oriented networks such as America Online and CompuServe, by the graphics-oriented Worldwide Web, and by easy-to-use Web browser software--Mosaic, Netscape, and the Microsoft Internet Explorer.

Information available on the Internet encompasses practically every aspect of human activity, from classic literature to technical documents, city guides, news, statistics, K-12 lesson plans, casual real-time conversation, academic discussions, electronic mail, photographic and artwork archives, legislation, and government services at federal, state, and local levels. Information is placed online by individuals, businesses, organizations, publishers, and government agencies. Although there are no exact counts, users of the Internet have been estimated to number 40 to 50 million, with perhaps as many as 17 million currently in the United States, according to some estimates, and rising rapidly. California has been among the leading states in its citizens' and businesses' use of the Internet.

New technologies are bringing Internet access by way of cable, telephone lines, and wireless communications systems. New access devices promise to make access as simple as turning on a television set and navigating from site to site with a handheld remote control. "Smart cards" and other electronic payments methods could enable easy, secure online payment for purchases, thereby making the Internet an important part of the consumer economy.

Especially in view of its rapid and continuing growth, the Internet is important to California and raises issues of public interest for several reasons. These include:

- California state agencies are increasingly using the Internet as a means of providing services and information.

- The Internet serves as a means of communications among state and local agencies and between citizens and their government.

- Those state presences online raise complex and difficult security issues.

- Increasing use of the Internet for business and commerce is raising or complicating issues in the areas of regulation, trademark protection, taxation, and competitiveness.

- Demands are growing for public education to provide access to the Internet for use by students, teachers, and administrators, raising issues of how to pay for and implement

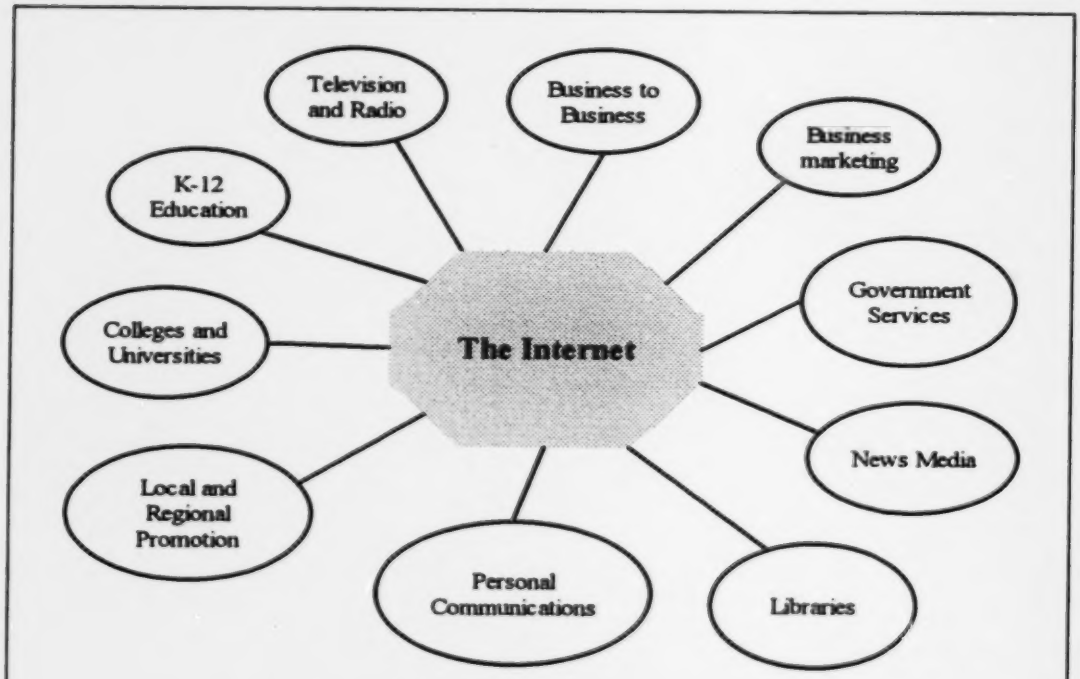
access, standards for use of the Internet, and changes that may be needed in curriculum and methods.

- California firms have an important role in the Internet industry in the areas of hardware, software, communications, and content.

- The privacy rights of Californians may be compromised by posting of personal information and by interception of private communications online, and some online activities may be hazardous to personal security.

- Concerns about equitable access to the Internet are growing as it becomes increasingly important in commerce, government, education, and entertainment.

This paper reviews the background and key terminology of the Internet, its current scope and use, and a selection of public policy issues. The paper also provides examples of the California state government and federal presences on the Internet and summarizes a selection of sites illustrating the myriad types of private-sector online services and information.



The Internet Provides a Shared Communications Channel

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The Internet: A California Policy Perspective

"This is the '90s, man, *anything* is possible." (Customer overheard at IHOP, Bakersfield, August 1996)

"Computing is not about computers any more. It is about living." (Nicholas Negroponte, *Being Digital*)

"[T]he medium is being oversold, our expectations have become bloated, and there's damned little critical discussion of the implications of an online world." (Clifford Stoll, *Silicon Snake Oil*)

INTRODUCTION

The rise and explosive expansion of the Internet and the Worldwide Web could have as profound an effect on society as did the rise of the automobile nearly a century ago. The Internet, the private preserve of a technical elite only a few years ago, is now used daily by millions of people around the world for work, research, education, entertainment, shopping, and personal communications. As the Net has opened to the general public, it has also blossomed into a graphically oriented and commercially driven environment unimagined by its originators. The Internet is a valuable tool, but it does raise a wide range of new policy issues and bring a new dimension to some old ones.

Why is the Internet Important to California?

Especially in view of its rapid and continuing growth, the Internet is important to California and raises public issues for several reasons. These include:

- Californians make heavy use of the Internet, and have been estimated to represent about a quarter of all U.S. users of the Internet.[1]
- California State agencies are using the Internet to provide services and information to the public.
- The Internet is a means of communication among State and local agencies and officials and between citizens and their government.

[1] Although exact counts do not exist, users of the Internet have been estimated to number 40 to 50 million worldwide, with perhaps as many as 17 million currently in the United States, according to some estimates, and rising rapidly. *Boardwatch* magazine, a computer/communications industry publication, is more conservative in its estimate, suggesting that about 10.4 million persons in the U.S., or about 3.9 percent of the U.S. population, had Internet access as of May 1996. *Boardwatch*'s worldwide estimate is 17 million, or about 0.3 percent of world population on line. ("Introduction to the Directory of Internet Service Providers," Spring 1996, posted at http://www.boardwatch/com.)

- State use of the Internet raises questions about the security of government Internet sites and of information posted on and sent to and from those sites.

- Use of the Internet for business and commerce is raising or complicating issues in the areas of regulation, trademark protection, taxation, consumer protection, and competitiveness.

- Public schools are using the Internet to serve students, teachers, and administrators, raising issues of how to pay for and implement access, standards for use of the Internet, and changes that may be needed in curriculum and methods.

- California firms have an important role in the Internet in the areas of hardware, software, communications, and content. Prominent California firms include Intel (microprocessors), Netscape (browsers), and Cisco Systems (internetworking hardware).[2]

- Information posted online poses risks to California residents' privacy and security.

Concerns about equitable access to the Internet are growing as it becomes increasingly important in commerce, government, education, and entertainment. The role of the State in assuring equitable (and safe) access is unsettled, especially in view of rapid changes in the technology and growth in the Internet.

Intended Audience and Purposes of this Paper

The intended audience for this paper is policy makers and the general public. This audience includes people with little knowledge of computers, communications, or networking *and* people with experience and knowledge in those areas. For that reason, I have tried to stay in a middle ground, introducing technical terms and explanations where necessary, but focusing more on concepts and on the policy issues raised by the growth of the Internet. In short, the paper seeks:

- To present an introduction to and overview of the Internet.

- To outline issues emerging from this exponentially growing technology.

Although information about the Internet is widely available, it is found in so many sources of such differing type and technical level as to be difficult to grasp. Further, the scope of the Internet's established and potential impact is so broad as to prohibit comprehensive

[2] In September 1996, the National Science Foundation awarded a $12.4 million grant to the USC Media Center, which will be matched by an additional $30 million in other funding, both corporate and governmental. It is expected that the result will be significant growth in related start-up companies in the area. Work of the Media Center, although not limited to Internet issues and technology, will have implications for the Internet on both the hardware and software sides. See Carol Troy, "USC's Media Center: Revenge of the West Coast Nerds," *New York Times* (online edition), September 27, 1996.

coverage of all the affected areas in a relatively brief paper. Instead, I have attempted to outline major issue areas and to summarize key concerns and policy options.

Almost every week during the research for this paper brought at least one significant new development or has revealed a prediction to be a *reality*, or nearly so, already. Some observers have claimed that time moves differently in cyberspace (the world of computer communications), that one "Web year" is the equivalent of five or even seven "human years." This is rather like the concept of "dog years." Those estimates may well be too conservative, at least in some respects and at the current stage of developments. The phenomenon brings to mind R.A. Lafferty's science fiction-fantasy story "Slow Tuesday Night." That story takes place in a world that moves with lightning speed, allowing financial empires and complex personal relationships to rise and fall in hours. Although I read that story long ago, it often comes back to me as I read daily of the changing world of the Internet.

Some of the issues touched on in this paper are only translations into the cyberspace setting of issues that long predate the Internet. I hope that bringing together many issues in one relatively short paper will give a new view that will help readers to understand the many issues raised directly and indirectly by the Internet and by its growth in content, application, and users. I have entirely omitted some Internet-related topics, such as how to select an Internet service provider, comparisons of Internet browsers, and explanations of Internet-access software. All of those topics are well covered in books listed in the bibliography.[3] Nor have I made any attempt at a comprehensive catalog of online resources, even within the scope of California State Government. There is simply too much available (and too much that is worthwhile) to permit that.

Also omitted from this paper (but planned for a follow-up analysis) is the issue of the telephone companies' "universal service" responsibilities and their potential impact on Internet access. The omission from this paper is in the interest of keeping the paper within manageable proportions and in recognition of the time that will be required to analyze the recent Federal Communications Commission recommended decision on universal service and related California Public Utilities Commission policies and proposals and to evaluate recent developments in the Internet industry in the light of those documents.

Policy options following chapters 2 through 6 are offered as suggestions for consideration only, not recommendations.

> **Note: A December 1996/January 1997 Nielsen survey estimated that there were then over 50 million Internet users in the United States, or almost one-fourth of all Americans over age 16. This figure was twice that found 18 months earlier. (Reported by Associated Press, March 12, 1997.)**

---

[3] The best single overview volume at this time is Glee Harrah Cady and Pat McGregor, *Mastering the Internet* (San Francisco: Sybex, 1996).

CHAPTER 1: WHAT IS THE INTERNET?

> "[T]here is a never ending quest to have the largest, best, and most munificent network, made up entirely of the work and investment of somebody else, and offer it for sale to the public." (Jack Rickard, editor of *Boardwatch Magazine*, 1996.)

This chapter describes the Internet and the Worldwide Web. It includes an overview, capsule history, explanation of how it works, and basic terminology. The chapter also looks at the kinds of information available on the Internet.

One perspective on the Internet is the relatively tangible *physical* perspective of computer hardware, communications lines, and the software that manages their connections. The other is the *conceptual* perspective of the roles played by the Internet. Both of these perspectives are important to an overall understanding of the technology and its growing role. The next few sections attempt to outline the background and basic ideas from both perspectives.

Background and Buzz-Words

In a nutshell, the Internet is a global *network of computer networks*. This means that a user at a computer on one network can send e-mail (electronic messages) to, or access information on, a computer connected to another network linked into the overall Internet anywhere in the world. Specialized programs and devices that make links, route messages, and keep track of the host computers on the Internet manage the system. These processes happen out of sight of the user. The user need not know anything about how the information is actually transferred or the route(s) taken by the message. Only an occasional error message or the routing information appended to e-mail messages in transit might hint at the hidden workings of the system.

Where did the Internet Come From?[4]

The Internet began as an effort to design a computer communications system that could let messages continue to flow even if a link were disrupted by disaster or attack. The result of research was a packet-switching network. (This and other terms are defined below in this chapter, or in the glossary.) In 1970, the prototype packet-switched network connected UCLA, UC-Santa Barbara, Stanford University, and the University of Utah, Salt Lake City:

> This was the start of the Internet--four universities connected by a packet-switching network that was funded by ARPA [Advanced Research Projects

[4] This section (except for post-1994 developments) is based on *The Internet Unleashed* (Indianapolis, Indiana.: Sams Publishing, 1994), Chapter 1, although I have severely abbreviated the coverage. A more thorough background discussion may be found in Chapter 3 of Ravi Kalakota and Andrew B. Whinston, *Frontiers of Electronic Commerce* (Reading, Mass.: Addison-Wesley, 1996).

> Agency]. If any one link of the network failed, information could still be routed via the remaining links. This satisfied the original criteria for developing a computer network that could withstand hostile attack--or, as it actually turned out, attacks of nature and civil war.[5]

By 1972, the network had expanded to 40 sites connected to what was then called "ARPAnet." Researchers had created ways to send short messages through electronic mail (e-mail), to control one computer over the network from another computer on the network, and to transfer large files between computers through FTP--"file transfer protocol." With these developments, the core technology underlying the Internet had been established.[6] However, the Internet as it is known today was not yet in place.

By the late 1970s, other networks connected research centers that were not part of ARPAnet and the National Science Foundation helped to fund creation of the Computer Science Research Network (Csnet). At the suggestion of Vinton Cerf, who with Robert Kahn had invented the basic Internet communications methods called TCP/IP (Transmission Control Protocol/Internet Protocol), Csnet, as a collection of independent networks, was linked via a "gateway" to ARPAnet:

> It can be argued that this was the real birth of the Internet. Keep in mind that the Internet does not exist as a physical entity. You cannot reach your finger out and touch anything that can be called the Internet. The Internet is a collection of independent, free-standing networks that have come to an agreement about how to talk to one another. That is what Vinton Cerf envisioned when he suggested coupling Csnet to ARPAnet.[7]

More networks quickly appeared, as did new network and inter-network software and techniques. Those techniques included methods for online group discussions and electronic mailing lists on specific subjects. By the late 1980s, the National Science Foundation had launched NSFnet to link selected supercomputer centers across the U.S. Previously, Milnet (Military Network) took over the military-related portions of ARPAnet. By 1990, ARPAnet had given way to NSFnet and terminated. As these and other changes took place in the existing structure, new networks came online, including CompuServe, Prodigy, and America Online, as well as networks established by various businesses primarily to serve their internal needs.

In May of 1993, the National Science Foundation began a process that would end the NSFnet and replace it with a new system centered on a few Network Access Points (NAPs), "where private commercial backbone operators could 'interconnect' much as they had using the NSFNet backbone . . . In February, 1994, NSF announced that three

[5] *Ibid.*, p. 8.
[6] *Ibid.*
[7] *Ibid.*, p. 14.

NAPS would be built . . . On April 30, 1995, the NSFNet backbone was essentially shut down and the NAP architecture became the Internet."[8]

With that transition, the Internet could move quickly toward full commercialization and could complete the abandonment of old standards, long in decline anyway, prohibiting commercial activity on the precursors to the Internet. Those standards limited use to educational, governmental, and nonprofit purposes. From about 1993 to 1995, such commercial services as CompuServe, Prodigy, and America Online opened e-mail gateways, and eventually much more complete access, to the Internet. In essence they became part of the Internet in the process.

The feature that has done the most to propel Internet growth is the ***Worldwide Web***. The Web, or "WWW," is not something separate from Internet. Rather, it is one of the techniques by which information is presented *on* the Internet.

The Cyber Dictionary defines the Web this way:

> The graphical lane on the information superhighway.
>
> It's the hottest trend since the hula hoop. "The Web" offers text, graphics, sound, and video all in place on the Internet.
>
> It is called the Web because its many sites are linked together. You can jump from one site to another by clicking on a highlighted word or "hot button" (a little graphic item).[9]

The WWW was created by researchers at CERN, the European Laboratory for Particle Physics (the acronym comes from its name in French). There Tim Berners-Lee and colleagues, in 1989, developed the concepts and basic methods of the Web as a means of sharing research. They had no idea that sound, video, or graphics would be included in the system. By 1991, the Web had become part of the Internet suite of services. After that:

> The project quickly expanded beyond all imagination as others understood the potential for global information sharing. Hundreds of people throughout the world have contributed by writing and modifying Web software and documents. In a way never envisioned by the original project group, the project reached global proportions by the middle of 1993 with the introduction of the NCSA [National Center for Supercomputer Application]

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[8] Jack Rickard, "Internet Architecture," http://www.boardwatch.com/isp/archit.htm, accessed August 29, 1996, pp. 3-4.

[9] David Morse, ed., *Cyber Dictionary: Your Guide to the Wired World* (Santa Monica, California: Knowledge Exchange, 1996), p. 304.

> Mosaic--a multimedia front-end [easy-to-use interface] to all the information served by the Web.[10]

Hypertext documents include embedded links, enabling a user to navigate from one part of a document to another or from one document to another (a process called "hyperlinking"), even if the documents reside in different computer files or even on different computers far distant from one another. In a sense, hypertext and the Worldwide Web make all of the information on the Internet into a vast interconnected library.

We will return to the subject of hyperlinking after looking into some terminology.

NAPs, POPs, and Backbones

Although the purpose of this paper is not to provide a technical explanation of networking or internetworking, a brief explanation of some of the unavoidable buzz-words of the Internet will still be useful. Some of the terms that come up again and again in any discussion of the Internet follow. Additional terms are defined in the glossary.

A ***domain*** is the name and type of site on the Internet. The domain is part of every Internet address. There are many domains, and each in turn is divided into subdomains. At the top level are edu (education), gov (government agencies within the U.S.), org (non-profit organizations), com (commercial organizations), net (networking organizations), mil (U.S. military), and more than a hundred national domains, such as ca (Canada), us (United States), and nz (New Zealand).

For example, the U.S. Government Printing Office is on the Worldwide Web at www.access.gpo.gov. This indicates, reading from right to left, the (U.S.) government domain, Government Printing Office, host computer called "access," Web page. (It is becoming customary, but is not necessary, to use "www" as the first part of a domain name for a Worldwide Web site on the Internet.) ***Domain name servers*** (***DNSs***) are computers connected to the Internet that associate domain names with the numerical ***IP addresses*** used by the system, so that users can remember something simpler than a string of dot-separated numerals such as "133.34.111.87." IP addresses uniquely identify a specific host computer on the Internet.[11] DNS can also mean "domain name system," the system of domain-naming rules and the database (organized list) of assigned names.

The concept of the ***backbone*** is fundamental to the Internet. Internet backbones are very high-capacity communications lines connecting major cities across the country.[12] It might help to make use here of the concept of the "Information Superhighway," so often used in reference to the Internet. Think of the backbones as the equivalent of hundred-lane, high

---

[10] Ravi Kalakota and Andrew B. Whinston, *Frontiers of Electronic Commerce* (Reading, Massachusetts: Addison-Wesley, 1996), p. 228.

[11] To be more precise, the IP address "expresses the exact physical connection between a computer and the network on the Internet." Cady and McGregor, *Mastering the Internet*, p. 78.

[12] This discussion will be limited to the U.S.

speed freeways linking a handful of major metropolitan areas. In turn, smaller freeways (perhaps twenty lanes) connect smaller urban areas to these "backbone" freeways. Still smaller freeways connect still smaller cities and towns to the twenty-lane freeways.

Eventually, we reach the level of a single-lane road that allows an exit to your driveway. That is the equivalent of the home telephone line. Little roads (communications lines) connect to bigger ones, and those to bigger (and faster) ones, culminating at the backbone level. This, in turn, attaches to a Network Access Point and then works back down to the driveway level again. At every step of the way, connecting devices--think of on-ramps, off-ramps, and interchanges--must attach one road to another. The metaphor is probably not worth working out in too much detail, but it still helps to show how the network works.

The "little roads" that go right to the individual home are sometimes called the ***last mile***. Those connections, whether by way of the ***telco*** (telephone company), cable company, or even electric utility company, involve a huge investment that is difficult and expensive to upgrade or replicate. Any entity with a last mile system has leverage in the electronic communications game.

An article in *Boardwatch* magazine (a computer/communications industry publication) summarized the backbone concept this way:

> When we refer to a "national Internet backbone provider," we are describing a company that has physically located a high-speed TCP/IP [Transmission Control Protocol/Internet Protocol--an Internet communications standard] router in a number of cities, and then leased high-speed data lines from long distance exchange carriers to link the routers--thus forming a national "backbone" connecting those cities. By doing so, they can then sell access to many individuals and companies within each backbone city, and the traffic between cities moves over the leased lines of the backbone. The leased lines can actually be purchased from different long distance companies for each city, and in fact some backbone providers will lease several lines from different carriers to connect two cities so that if one carrier happens to have a backbone incident [that is, crashes] and the link is lost, they still have a connection through the other carrier--maintaining their backbone at a perhaps reduced data rate. This is termed "redundancy."[13]

There is not a single backbone to the Internet, nor is there a single communications company providing or controlling access. Relationships and interconnections are complex and sometimes quite strange. *Boardwatch*'s Jack Rickard remarked, "Deals are cut between operators at and across all levels of the Internet to the point of frenzied

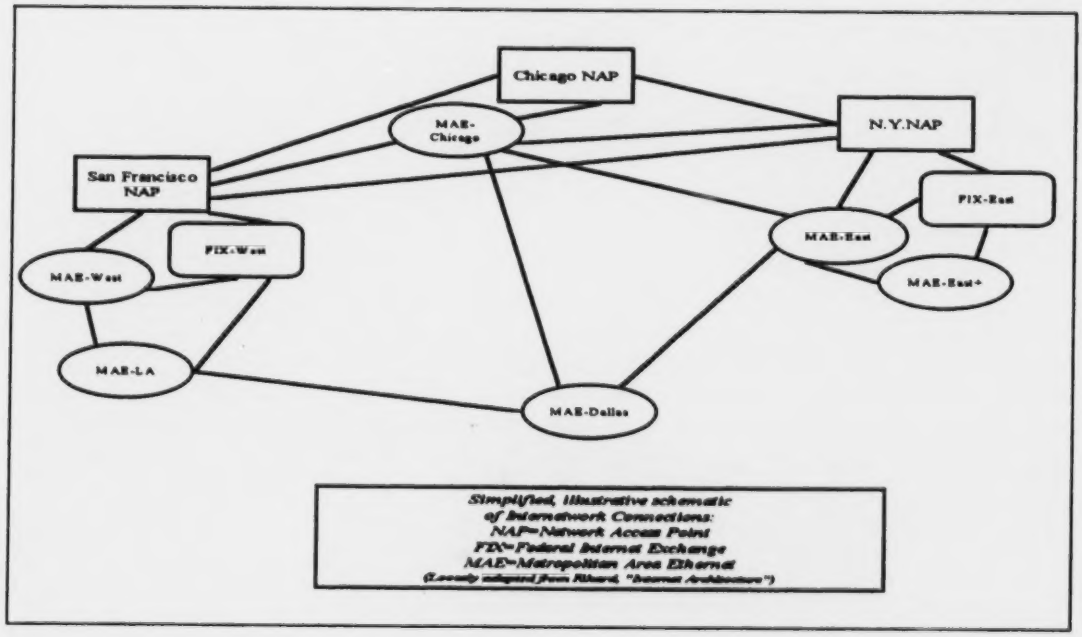
[13] Rickard, "Internet Architecture," page 7.

confusion." He went on to surmise that "some operators are agreeing to buy things from themselves through several third parties in some cases."[14]

A ***NAP*** is a "network access point," a physical point where backbone operators connect to the Internet. "Currently," writes *Boardwatch*'s Jack Rickard, "the heart of the Internet remains the three 'official' network access points or NAPs in San Francisco, Chicago, and Pennsauken, New Jersey, near Philadelphia. (The latter is referred to as the New York NAP.) They establish the concept that interconnection is good, and that at [at] least these three points, anyone can in theory interconnect with the rest of the Internet."[15] "In this way," he writes, "anyone could develop a national backbone for the connection of LANs [local area networks], sell connectivity to it, and use the NAP as the physical point where they interconnected and exchanged traffic with all the other service providers."[16] Other "major interconnections" cited by Rickard bring the total to eleven. Major providers connect to more than one, and possibly to most, of these points.

Figure 1 very broadly illustrates the layout. Do not take the connections literally, as they are intended only to give a general impression of the top level of the Internet.

Figure 1



[14] *Ibid.*, page 8.
[15] *Ibid.*, page 4.
[16] *Ibid.*, page 3. Elsewhere Rickard has speculated that the concept of national backbones and the role of NAPs could essentially disappear over time as local ISPs interconnect, moving to "hundreds and thousands of connections at lower levels in the hierarchy." Rikard, "Editor's Notes," *Boardwatch*, September 1996.

A ***POP*** is a more local version of a NAP. Again quoting Rickard: "Generally, we refer to all the nodes of the network owned by the national service provider as Points of Presence or POPS. Business customers then lease their own telephone line from the telco to this POP and so connect to the Internet."[17] That is, the business leases a line that connects to a POP, and the provider of the POP connects to a NAP, and once the connection is made to the NAP, the Internet has been accessed. It is almost as simple as NAP, crackle, and POP.

A typical home user of the Internet dials up an ***ISP*** (Internet Service Provider) through a modem in or attached to his personal computer. The user then has a telephone line connection to a vendor, who in turn connects to the Internet. ISPs (also known as Internet access providers) charge a fee (usually) for the user to connect, via them, to the ISP's Internet connection. In short, the home (or small business) user of the Internet connects via an ISP, which is in effect the retailer of Internet services. If an internet service provider (Netcom, for example) can be accessed by a phone call to a specific town, then that provider is said to have a point of presence--a POP--in that town.

Think of it this way: an enormous information freeway (Figure 2) connects San Francisco, Chicago, and New York (well, Pennsauken). That route is the heart of the system. Anyone who wants to can build a backbone (major information freeway) and connect it to one of those three points (NAPs), and in turn can have smaller connecting roads splitting off into more and more remote areas. Still smaller systems can connect to *those* systems. If you ("Mr. A," let's say) connect to any of the systems that ultimately connects to a NAP, then you can reach any point ("Ms. B," for example) connected to any other system likewise tied to a NAP. A system that does not somehow ultimately connect to a NAP is not guaranteed to have access to all of the Internet.

Routers are devices (encompassing both hardware and software) that forward messages from one network to another--that is, route them to their destination. Because the Internet encompasses thousands of networks, many routers are required to direct data from source to destination.

Packet switching refers to the method by which messages are ordinarily sent along the Internet. In short, a message is broken into packets (chunks, each with identifying information), which are relayed to the destination. The multiple packets into which one message might be separated will probably take different routes to their destination, and perhaps not even arrive in the order they were sent. The identifying information accompanying each packet allows their reassembly in the proper order at their destination. If a packet is lost en route, the originating computer is notified and resends it. This technology means that there is not a continuous, always-open connection from source to destination. Packet-switching facilitates efficient use of the lines, which can be filled with packets from and to countless destinations.

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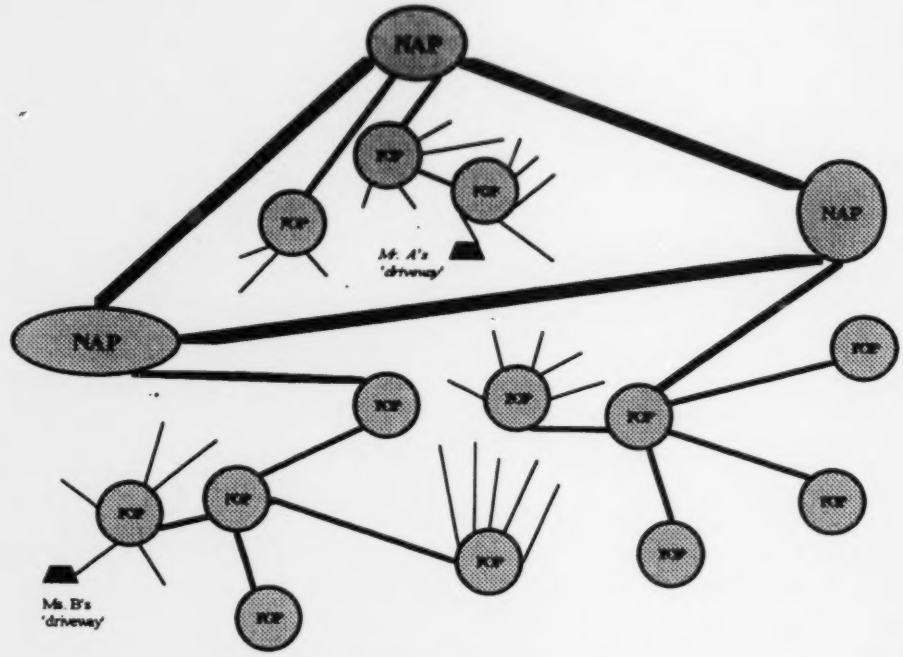
[17] Rickard, "Internet Architecture," page 7. Note that this kind of POP is not the POP that refers to "Post Office Protocol," a means for handling e-mail. A "node" is a point where equipment connects to a communications line.

Figure 2



HERE A POP, THERE A POP . . .

Picture a busload of people (one large message) being delivered across country in dozens or hundreds of pieces (packets) by way of dozens of highways, selected on the fly depending on what is available and efficient at that instant, intermingled along the way with packets broken out from countless other buses, trucks, and automobiles, and reassembled at its destination, all in the blink of an eye. That is packet switching. It requires a lot of hardware and software to make it work, but is a very efficient way to use the telecommunications lines.

The system is also ***connectionless***, as there is not a continuously open connection from source to destination. That contrasts to a telephone call, during which a connection is made and kept open for two-way communications until the call ends. (Now you know what a *connectionless packet-switched network* is.)

Protocols are the "standard operating procedures" of networks. Protocols specify the technical details of how the intricate tasks of network communications are to be handled. Fundamental to the Internet is ***TCP/IP***, or Transmission Control Protocol/Internet Protocol, the instructions governing how packets are sent on the Internet and how errors are handled.

Bandwidth is the "size of the information pipeline," so to speak. It is a measure of how much data can be delivered across the line how fast, usually expressed in thousands or millions (or even billions or trillions) of bits per second. A bit is a single binary digit, a 1 or 0 ("on" or "off"). All digital data, however complex, are at bottom simply a stream of bits--zeros and ones. More bandwidth equals more capacity to transmit information within a given period of time.

In highway terms, a 100-lane freeway has ten times the bandwidth of a 10-lane freeway. In telecommunications terms, a T3 line, at 44.736 Mbits/s (megabits per second) has 28 times the bandwidth of a T1 line, at 1.544 Mbits/s.[18] Bandwidth has nothing to do with how fast bits move. They move at the speed of light *whatever* the capacity of the line. Fiberoptic cable (a highly polished glass or plastic cable that transmits light rather than electrons) has vast bandwidth, but not because the actual transmission speed is faster. Light (on fiberoptic cable) and electrons (on phone lines) both move at the same speed. The limiting factor in data transmissions is how quickly the medium can change signals.[19] To illustrate: in theory, digital data could be sent via smoke signals, but the bandwidth would be measured in bits per minute, not thousands or millions of bits per second because of the time needed to produce smoke puffs and to interpret them for retransmission along the next link. The light transmitting the puffs would, of course, move *at* the speed of light.

Three more terms often come up in discussions of bandwidth, **narrow-band**, **midband**, and **broadband**:

> Cables with limited bandwidth, used for text or voice transmissions, are called narrow-band circuit. Cables with more capacity, which carry images and limited animation, are "midband capable." Those with a high bandwidth, which can carry multiple video and audio signals, are said to have broadband capacity.[20]

Congestion occurs wherever the bandwidth is insufficient to handle the load at that point. The ***telco*** (telephone company) line into your home, designed for ***POTS*** ("Plain Old Telephone Service") has low bandwidth. By the time the Information Superhighway has gotten to your monitor, it has shrunk to an Information Bicycle Path (Figure 3). That fleet of 18-wheelers you ordered up on the Web will end up coming your way as a seemingly

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[18] Yes, I know, if you do the arithmetic the ratio is much closer to 29:1. Nonetheless, a T3 line "supports 28 T1s," according to the *Dictionary of PC Hardware and Data Communications Terms*. A T4, in turn, carries six times the bandwidth of a T3. Backbones require high bandwidth, and therefore are moving toward *gigabit per second* (billion bit per second) levels. There is even talk of terabit levels (trillion bits per second). The potential traffic on higher bandwidths now under development, however, cannot be accommodated by current switching and routing technologies, so advances must take place across a broad range of technology. See Kalakota and Whinston, pp. 110-115.

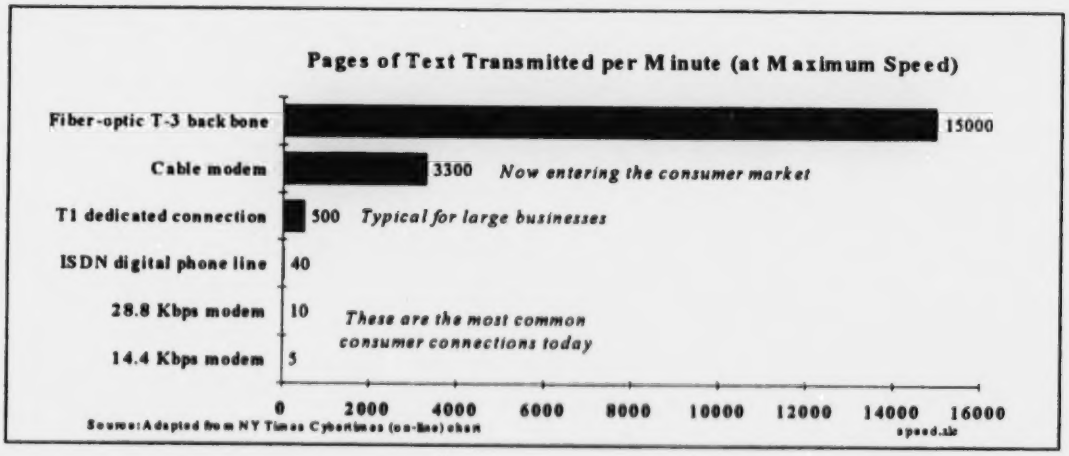
[19] Douglas E. Comer, *Computer Networks and Internets* (Upper Saddle River, N.J.: Prentice Hall, 1997), pp. 21-22.

[20] Bill Gates, *The Road Ahead* (N.Y.: Viking, 1995), p. 31.

endless parade of bike-sized packets, virtual handle-bar tassels flapping in the electronic wind. Every one of tnose packets will follow an individually-scripted route designed on the fly, one router at a time.

In a system this complex, there are many places along the way where things may go wrong or where congestion may occur. A router might be misbehaving, DNS might be swamped, or the particular site one is trying to reach might be overwhelmed by many requests at the same time. Internet error messages are often ambiguous or misleading, but often mean the same thing: *it is too crowded right now somewhere along the way.*

Figure 3



No One Controls the Internet

Controlling the Internet is almost as alien a concept as herding cats. It is just not in the nature of the beast to be run from a central location or organization. (But each individual *network* connected to the Internet does have its own administration.) Nonetheless, technical standards and various coordinative activities are the responsibility of specific organizations and are essential to the success of the Internet. In time, the Internet cats find that a particular direction is good, and they follow it (Figure 4).

Sharon Eisner Gillett puts it this way:

> Contrary to its portrayal as total anarchy, the Internet is actually managed. It runs like a decentralized organization, but without a single person or organization filling the manager's role. The system that allows 99% of day-to-day operations to be coordinated without a central authority is embedded in the technical design of the Internet. The manager's job--

handling the exceptional 1%--is performed by not one but several organizations.[21]

Figure 4

CATS GAZING IN A DIRECTION THEY HAVE FOUND TO BE GOOD

Internet organizations include:[22]

- InterNIC Registration Services, which registers domains, names, and addresses of computers connected to the Internet in the top-level domains *edu*, *gov*, *com*, *net*, and *org*. InterNIC charges a fee for this service. (Other registries handle other top-level domains, under the overall direction of Network Solutions, Inc.)

- The Internet Society (ISOC), an international group of volunteers, founded in 1982 in Reston, Virginia. Membership is open to all interested persons, although there is a fee. The Internet Society coordinates work of various other groups associated with Internet policy and practice.

- The North American Network Operators Group (NANOG), which handles North American network operations.

- Computer Emergency Response Teams (CERT), addresses security matters, coordinated by Forum of Incident Response and Security Teams (FIRST).

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[21] "The Self-Governing Internet: Coordination by Design," prepared for Coordination and Administration of the Internet, Workshop at Kennedy School of Government, Harvard University, September 8-10, 1996. Posted at http://ccs.mit.edu/ccswp197.html. The quoted passage is from page 1 as printed.

[22] This list has been selected and adapted from *The Internet Unleashed*, *Mastering the Internet*, and *The Cyber Dictionary*, with an occasional glance at other sources.

- Internet Architecture Board (formerly Internet Activities Board), IAB, a technical group overseeing the development of the suite of Internet protocols (standard methods). IAB oversees the Internet Engineering Task Force (IETF) and Internet Research Task Force (IRTF). The latter is more theory-oriented than the former.

- The World Wide Web Consortium, W3C, "an industry consortium which seeks to promote standards for the evolution of the Web and interoperability between WWW products by producing specifications and reference software." This is strictly an industry group; in contrast to the Internet Society, there is no individual membership. Its focus is the Web, not the Internet generally. The group notes, "W3C . . . is vendor-neutral, and its products are freely available to all," despite its industrial member funding.[23]

"Standards on the Internet," states Ron Dippold in *The Internet Unleashed*, "are created in a wonderfully anarchic manner. Any person (or group) who thinks he has a good idea prepares an RFC (Request for Comments) detailing his proposal. If other people think the idea is good, it will be implemented. If not, it will languish, unused."[24] RFCs are posted online (InterNIC assigns numbers to them), and may be retrieved by anyone who is interested. They are also published in CD-ROM format.

Anarchic or not, the Internet as a whole is clearly not centrally controlled, but it *does* have a management system that develops, publicizes, evaluates, and implements standards in critical technical areas.

Navigation on the Net: Hyperlinking

A little further on, we will look at the kinds of information available on the Internet. For now, though, let's just acknowledge that many, many kinds of information are online, provided by an enormous array of individuals and organizations. Information resides on millions of computers linked to the Internet and communicating as described above.

A user of the Internet can visit a specific site online (or many of them, one after another) by typing in each site's address. By this means it would be possible, but awkward and slow, to go to a series of related sites, one at a time, each time entering the Internet address found in, say, *The Internet Yellow Pages* or some other reference.

Hyperlinks enable the user to select an embedded link (by clicking with a mouse or moving the cursor to the link and pressing the enter key) and in that way to go to the address the link points to *automatically*. This process can continue from one site to

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[23] "About the World Wide Web Consortium," posted at http://www.w3.org/pub/WWW/Consortium/.
[24] *The Internet Unleashed* (Indianapolis, Indiana: Sams Publishing, 1994), p. 211. For another view of the management of the Internet, see Sharon Eisner Gillett, "The Self-Governing Internet: Coordination by Design," prepared for Coordination and Administration of the Internet, Workshop at Kennedy School of Government, Harvard University, September 8-10, 1996 (posted at http://ccs.mit.edu/ccswp197.html).

another, on and on and on. The user can move back and forth among links in this way, crafting a path meeting the immediate needs and interests.

Picture a student in a library reading room, at a table with a book--say, *Moby Dick*, by Herman Melville. If she wished to learn more about Melville, she would have to get up and go to a catalog to find a book on Melville, and then get that book, or would have to look him up in an encyclopedia. To find out more about the America of Melville's day, she would have to get another book or turn to another entry in an encyclopedia (maybe many entries). She might also search for magazine and journal articles, photographs, paintings, and other types of information source.

To find other books available from the publisher of this edition of *Moby Dick* (The Library of America, for example) would require writing to request a catalog. These traditional manual methods work, but are time consuming. Much of that time is taken up in simply moving around and physically retrieving documents--or in finding out where to get them.

Now imagine that student seated instead at a computer connected to the Internet, viewing an online copy of *Moby Dick* (Figure 5). If that version of the book includes hyperlinks (for the sake of discussion let's say that it does), the student could simply click on *Herman Melville* and the browser would go out on the Net and fetch the referenced biography of the author. Links embedded there might enable her likewise to jump to information on New York City (Melville's birthplace), Liverpool (where he went in 1837 as a cabin boy), or to a list of his other works (*Typee*, *Omoo*, and others). She might then jump to *Omoo* to see whether that is another book she wants to read. Similarly, she might jump to the publisher's Web site to examine its catalog, to a gallery of photographs of Melville, to some video clips about whales and whaling, or to any other topic for which links were provided. If the links were not sufficient, she could search for additional information via search engines or online libraries. All of this information would come via the Internet.[25]

Some critics, such as Sven Birkerts, cringe at the effect of this sort of information grazing on how people will learn, whether online or via a multi-media CD-ROM. They fear a disappearance of reading in depth and its replacement by endless lateral branching out. Others, however, see hyperlinking through the Internet and multi-media CD-ROMs as a means of learning that will broaden interests and expand knowledge by removing the barriers that now interfere with exploration of knowledge.

One thing is certain: the ability to hyperlink through knowledge is limited only by what is online. As the already astonishing scope of information online continues to expand, so too will the ability to follow unique paths of interest, whether to meet professional needs (technical, legal, or business information) or personal ones (such as health information, recipes, or world news).

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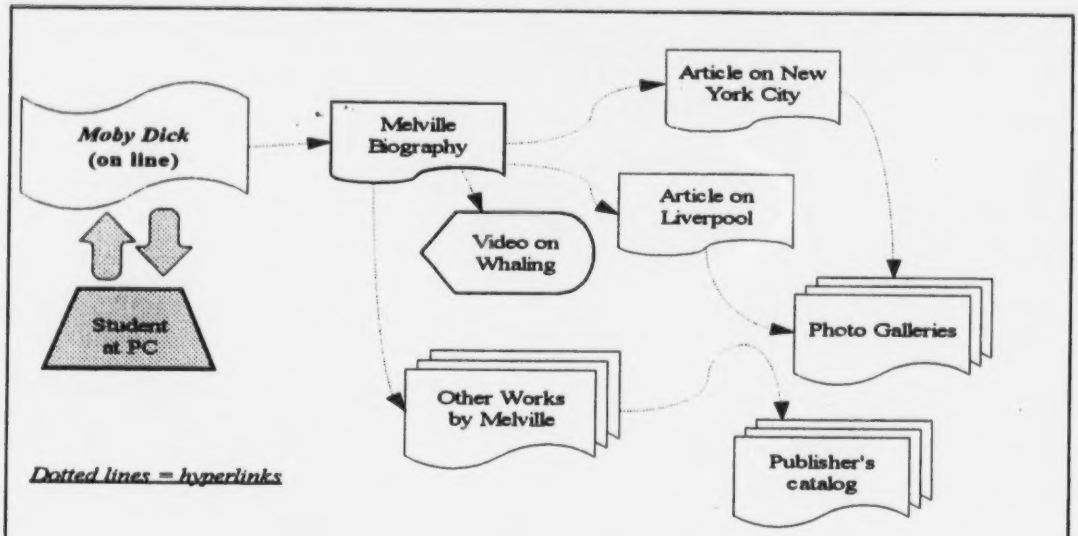
[25] The same could be achieved on a CD-ROM. The difference is that the CD-ROM's content is static, limited to whatever was put on the disk, while the Web's content is dynamic and enables additional, *ad hoc* levels of linking and keyword searching for additional resources.

Hyperlinking through the Web is a remarkable process, and one that comes as a surprise to those who first encounter it. One manager in a State department had to advise his employees, recently provided Internet access for official use, not to lose months of work to the phenomenon, as "the Web can be very seductive."

Figure 5



HYPERLINKING THROUGH A RESEARCH ASSIGNMENT

The Internet is Interactive

The Internet is an *interactive* medium. Although a user can simply look for information and read it online or download it to a personal computer, many users also post messages, chat online, and reply in various ways to what they find online. This makes the Internet fundamentally different from one-way communications media such as radio and television broadcasts and printed publications. Even the search for information on the Internet requires some interaction, as the user must navigate to a search engine, enter the topics desired, and select sites to visit. The user is sending instructions that result in the selected pages appearing on the screen. At the same time, the site the user is visiting may keep a record of the visit and even log certain information about the user, sometimes on the user's own hard disk. (This topic is discussed further in Chapter 5, below.)

The Internet is both Global and Local

One of the Internet's strengths at the same time adds to the complexity of issues it raises: it is *international*. Users from opposite parts of the globe can communicate as easily as can users who live next door to one another. The primary limitation on their ability to do so is in their own neighborhoods, reflecting the local communications infrastructure and

bottlenecks in national systems. Those systems vary *widely*, from virtually non-existent in many developing nations to advanced and broadly accessible systems in industrialized nations. Finland, for example, is regarded as one of the most connected countries on Earth.

Kalakota and Whinston estimated that over 140 countries have access to the Internet, and note that "the Internet has always been an international network." Each of the connected countries has its own approach to the Internet:

> Asian countries see the Internet as [a] way of expanding business and trade. Eastern European countries, longing for western scientific ties, have long wanted to participate but were excluded by government regulation. Since this ban was relaxed, development is progressing rapidly. Third World countries that formerly did not have the means to participate now view the Internet as a way to raise their education and technology levels.[26]

The Internet creates an international community by letting people in all of the connected countries talk to one another via e-mail and data files, and now even by live audio and video. This, then, lends an international aspect to matters that otherwise would be national or local. Issues related to the international nature of the Internet are touched on elsewhere in this paper.

Although the Internet is global, it may also serve local purposes. In a very loose sense, the Internet is like the daily newspaper. The newspaper includes articles about events in distant countries and it includes articles and advertising about large, international companies. But the paper also includes local news, advertising for local merchants, and classified advertising placed by businesses, organizations, and individuals in the local area. The reader may focus on the international coverage or may focus on purely local information.

Likewise, with the aid of Web sites that organize links to local information and that provide locally oriented content, an Internet user may focus on a local area. This sort of local use of the Internet is growing, and is the focus of competition between local interests and commercial entities that are seeking to develop many city and regional sites.

Microsoft, for example, has announced plans to develop city-oriented sites, a feature called "Cityscape." CitySearch, already established in a few cities, is developing similar plans nationwide, and Yahoo! (a search engine company) is also entering the field.[27] At the same time, however, locally-based interests are developing local-interest Web sites. The *Knoxville News-Sentinel* has such a site serving its area, with links to local event information, merchants, and news.[28] A local Web site serving Taos, New Mexico, offers

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[26] *Frontiers of Electronic Commerce*, p. 115.
[27] Steven Levy, "Rise of the City Sites," *Newsweek*, September 30, 1996, p. 86.
[28] http://www.knoxnews.com/.

extensive information on local business, culture, events, and institutions.[29] Hyperlinking makes development of local sites simple, and as more and more businesses, organizations, and agencies are on the Web this is an area that will grow quickly.

Fast-Growing Medium for Communications and Learning

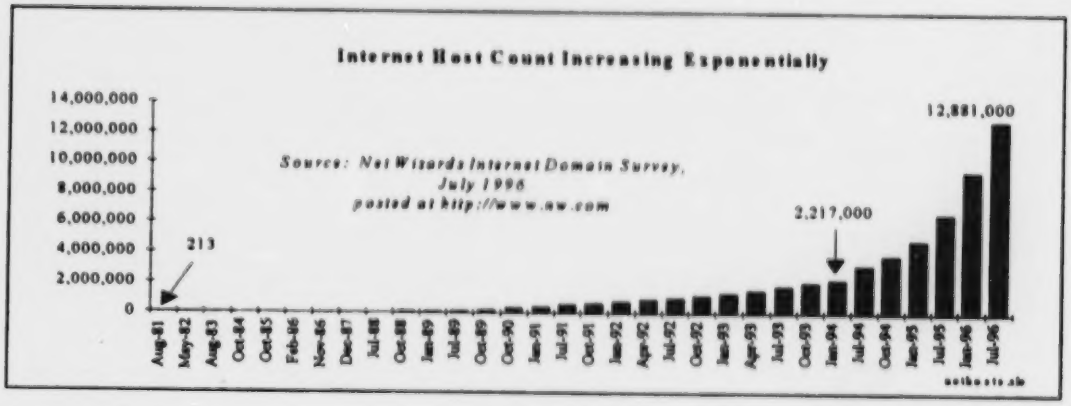
The Internet is a channel for communication and learning. A woman posted this comment to a philosophy-oriented mailing list on the Internet:

> When I first got this computer, I didn't even know where the on switch was. I was completely computer illiterate. But I KNEW that this machine could do wonderful magic things. I knew it could open up the world to me. If I just knew HOW to ask it to do it. When I finally learned a few of the secrets of this magic machine I was not disappointed in the wonders available to me.

This is a strong statement: *"I knew it could open up the world to me . . . I was not disappointed in the wonders available . . . ."* Anyone thinking about the Internet should bear in mind that beyond the computers, routers, bridges, T1 lines, and a host of arcane and acronymic devices lies a vast and multi-faceted community of *people*. As that community expands, so too does the potential power of the medium.

Indeed that community *is* expanding, and with an accelerating speed that almost defies comprehension (Figure 6). This is one reason why the Internet is such an important topic. It shows no sign of slowing or even leveling off in its growth. Even though its current rate of growth cannot continue forever, it need not continue for much longer before essentially saturating the potential market in the industrialized countries, especially the United States.

Figure 6



[29] http://www.laplaza.org/.

Other indicators all show the same kind of trend: accelerating growth with no sign yet of leveling off. Estimates typically indicate that the Internet is doubling or more *annually*, by whatever measure one chooses. The Worldwide Web aspect is growing even more rapidly, climbing from little above zero "WWW-Prefixed Hosts" in mid-1994 to about 60,000 in December 1995, 150,000 in April 1996, and about 220,000 in July 1996.[30] Eventually the rate of increase has to level off, but when that will happen is anyone's guess. New methods of accessing the Internet and breakthroughs in ease-of-use could support the growth trend for years to come.

What Can You Find Online?

The United States District Court for the Eastern District of Pennsylvania found, "It is no exaggeration to conclude that the content on the Internet is as diverse as human thought."[31] For that reason, it might be more reasonable to ask what you *cannot* find online than to ask what you *can*. That list is becoming shorter by the day. When I started this section, the list appeared to include text of current, copyrighted books, the equivalent of "white page" listings of all Internet users, and . . . well, that seemed to be all. Within a week, both of those exceptions had to be deleted: announcements had appeared for online access to published books (including a way to pay online for viewing or downloading the contents) and for a white pages system (far from complete, but a start--and competitors have already appeared).

Plumbing the Depths

In a test early in September, 1996, I picked out of thin air a topic that seemed unlikely to be well represented on the Internet: *plumbing*. After about two minutes spent accessing a search engine (Altavista),[32] entering the search term "plumbing," and scanning the results, I was led to a 13-page illustrated paper on "The History of Plumbing in America." A moment later I moved to the home page housing that paper and found I could also choose from "The History of Plumbing in Babylonia," or Crete, or Egypt , or any of several other civilizations. Other choices on that page included plumbing supply companies, plumbing (and allied) contractors, an article on "Diane Sawyer on Plumbers," and too much more to list here. There was even "Toiletology 101: A Complete Course in Toilet Repairs"! This is pretty good success for the most unlikely of topics.

What else can you find online? Here is a sample, in no particular order:

- Magazines and newspapers (literally hundreds, if not thousands).

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[30] In Network Wizards' definition, a "host," as used in the Internet Domain Survey, is a computer with an IP address and a connection (full-time or part-time, direct or dial-up) to the Internet. There are other, less inclusive definitions of "host." The WWW-Prefixed Host numbers are estimated from Network Wizards chart at http://www.genmagic.com/Internet/Trends/slide-6.html.

[31] Preliminary injunction issued June 11, 1996, in the case of *ACLU vs. Reno*, challenging the Communications Decency Act, in finding of fact no. 74 (text posted on line).

[32] Search engines are explained in the next section.

- Museums and scientific exhibits, including the Exploratorium (San Francisco) and the Monterey Bay Aquarium.
- Books, in electronic text (e-text) form, including classics in English and many other languages.
- Library catalogs, including those for the University of California and the Library of Congress.
- Weather information.
- Census data.
- State documents and information (California and other states).
- Businesses and business organizations.
- Commercial catalogs (retail, wholesale, services, and products).
- Agricultural data and advice.
- Special interest discussion groups on every topic imaginable.
- Job information, including job-search tips and job listings.
- College classes.
- Election data and political campaign information.
- Presidential and Congressional documents.
- Photographic archives and sound clip archives.
- Electronic mail ("e-mail") access to people all over the world.
- Real-time conversation ("chat"), likewise with people all over the world.
- Financial information.
- World, national, local, and special-interest news.
- Search engines for finding specific information on the Internet.
- Humor, parodies, and satires.

More appears online daily, added by individuals who do so as a hobby, by public and nonprofit organizations doing so as a public service, and by businesses seeking to make money by providing information or services or by selling goods. Of course, much of what is online is not worth the time it takes to look at it, just as much of what appears in any other medium is of little value.

Some Web sites provide customized information. For example, some travel-oriented sites provide local maps and even spell out street-by-street routes for getting from one place to another that you specify.

As more and more people see what is already online and find useful information and services, demand may grow for other information and services not already available, although it is becoming difficult to think of any type of information not already online in some form or to some degree.

Search Engines and the Hunt for Internet Information

The enormous number of sites on the Web and documents on Internet would be impossible to use without the aid of "search engines," services that find information at the user's request. Many sites offer search services. These include Yahoo!, Altavista, and Lycos. The user enters a word or phrase, submits the request, and after a while (seconds or minutes) receives a list of sites matching some or all of the search terms. Searches can be simple or complex. Each engine offers its own methods and options, and not all will find the same sites or find sites in the same order. Some sites offer subject-area guides to help the Web-surfer start through a topic without having to enter specific search terms. Many Web sites, especially those for libraries, include links to one or more search engines.

Unfortunately, search engines are not (yet, at least) very good at filtering what they find in order to present the most relevant or useful documents. The user may have to scroll through many trivial or off-the-mark links before finding one that is useful. This is a result of the ability of the search engines to find and index millions of documents on the Internet. Nonetheless, search engines reduce an impossible task--finding and searching among millions of sites--to the merely difficult task of examining a list of perhaps 200 links, many of which can immediately be dismissed as not helpful.

Information Hierarchies on the Web

One of the most striking and useful developments on the Web is the evolution of link pages that serve as tree-structured directories of information. Hyperlinking allows sites to be indirectly joined in many ways, reflecting different ways of viewing the information in and purposes of the sites. For example:

- Local government link pages ease access to local government sites across the country.

- City and regional pages join a variety of sites serving their respective geographic areas--businesses, schools, newspapers, radio and television stations, non-profit organizations, churches, and government agencies.

- Topical pages gather links to sites around the world concerned with a particular topic--for example, technology, insects, oceanography, movies, broadcasting, or social services.

Such link-oriented sites are themselves in turn gathered into more inclusive Web sites, creating a branching tree structure that starts at a higher, more general level. For example, a site might bring together links to all known city or regional Web link sites, so that the user could browse among listings of cities and regions across the country, if not around the world. In turn, even *higher* level sites could offer links to *those* sites. (These are not speculations. Such Web sites do exist.)

The ultimate site may be The WWW Virtual Library,[33] a catalog of subject-based links (when printed, filling four single-spaced pages, as of September 24, 1996), to sites literally from A (Aboriginal Studies and Agriculture, among others) to Z (Zoos). This site alone contains links to more information than any one person could absorb in a lifetime.

Frankly, this all sounds very confusing until one looks around at the choices on the Web. It becomes much clearer with experience.

Active Agents can Aid Internet Users

"Active agents" are computer programs that act on behalf of the user to find, filter, and deliver information. This is an area that, like so much else in the world of Internet, is still in its infancy, and like any infant may offer many surprises as it matures. Considering the overblown and largely disappointed expectations for "artificial intelligence" a few years ago, hopes for active agents should be restrained. They will not work miracles, but they can do useful work by easing, automating, and expediting tasks online.

A simple example of an agent is the Amazon Bookstore notification service. A customer may sign up for notification of new books on specified topics (for example, African History, Chemical Engineering, or Electronic Commerce). When a book is added to the store's catalog in the specified subject, e-mail goes out to all those who have requested notification, advising of the new arrival. In this way, the customer need not keep checking back for new listings, nor go though complete listings to look for new arrivals.

An agent might search the Web daily to find new articles mentioning an individual, company, or topic (much like a clipping service), arrange the articles according to some criterion of relevance, and send the text to the user for later reading or printing off line. Or an agent might be assigned to search commercial sites for the best price on Size 7

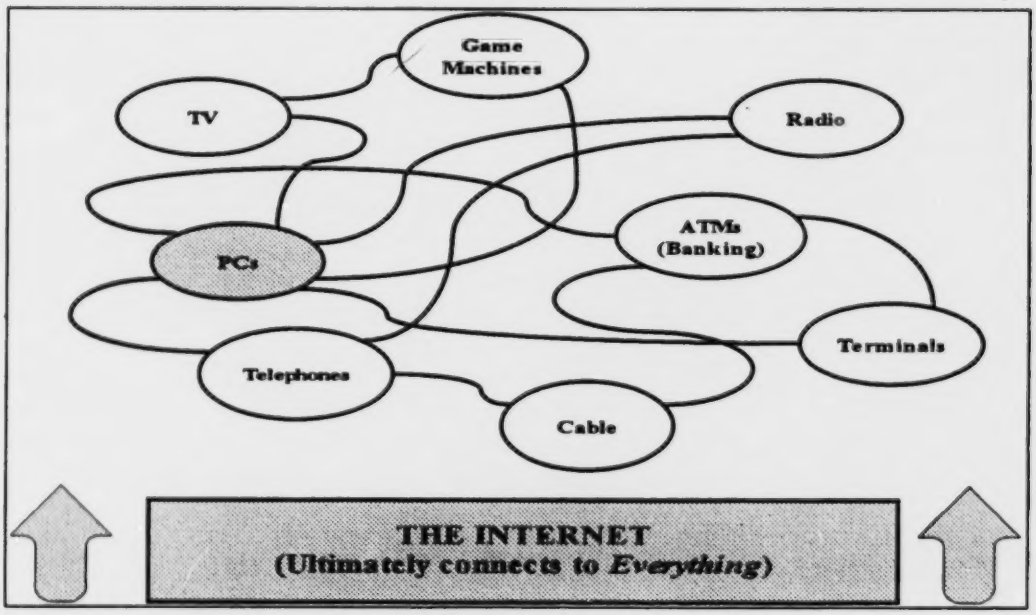
[33] http://www.w3.org/pub/DataSources/bySubject/Overview.html.

Widgets, educational sites for college courses in C programming, or government and legal resource sites for laws and regulations on driver's license renewal. Such actions would combine the processing ability and speed of the computer with the access to information provided by the Internet.

New Internet Access Methods

Internet-access technology is rapidly developing and cross-breeding with other technologies (Figure 7). The various access methods are being designed to meet needs and preferences of market segments not necessarily well served by the familiar PC, modem, and SLIP/PPP connection. They are also being designed to use existing infrastructures (such as cable systems) and devices (such as TV sets and video game machines).

Figure 7



"WebTV" Might Make Mouse Potatoes of Us All

WebTV[34] is an easy-to-use combination of Web access and television introduced in 1996. Other systems of this type are likely to follow,[35] and some new television sets will come

[34] There is a dispute over the ownership of the trademark "WebTV." I use the term to refer to the products and services of a partnership headquartered in Palo Alto, California, having licensing agreements with Sony Electronics, Inc., and Philips Consumer Electronics Company. Information on the partnership and its products may be found at http://www.webtv.net. The other claimant of which I am aware is on the Web at http://www.webtv.com. I neither express nor imply an opinion as to the rightful ownership of the trademark.

[35] RCA will produce and market something similar starting in the spring of 1997.

"Internet ready." Versions of the WebTV device made by Sony and by Philips started appearing in stores in October 1996, at a cost of $329 plus a $19.95 monthly charge for access to the WebTV service.

The WebTV system consists of a TV-top box that houses a special-purpose computer to make the television set into a Worldwide Web screen. The service includes access to the Web through an on-screen menu, e-mail, and other features. A handheld remote control operates the box, and an optional keyboard is available. The device allows the TV set to display Internet sites, taking the place of a standard computer monitor, and to receive regular television signals (but not both simultaneously unless the user has a TV with "picture in picture" capability).

If WebTV or something like it succeeds in the market despite its initial lack of printer capability and lack of disk storage, that success could generate a spurt in sites *designed* for that type of system. Those sites would feature immediate entertainment or quickly grasped information not calling for printing or saving--sound and video clips, brief news summaries and announcements, graphics, interactive applets (small embedded software applications), games, chat, and so on. A growth in such sites could then spur further interest in WebTV and similar Internet access devices.

Cable Companies Seek a Role as Internet Access Providers

Cable TV systems have enormous downstream (toward the user's home) bandwidth. That enormous bandwidth offers an opportunity for cable operators to put their last mile infrastructure to a new use: Internet access. The key limitation is that the *upstream* bandwidth is relatively small, posing a bottleneck in the system.[36] It would, however, be convenient for the consumer to have Internet access over the existing system (no additional bill to pay, as the same company is providing both regular cable and Internet access).

Cable's downstream speed allows Web pages to appear almost instantly on the screen, in contrast to the slow, chunky, and crawling appearance usually experienced over POTS lines. This speed offers a large advantage over WebTV and similar devices that access the Net through modem and phone lines. (Cable Internet access requires a "cable modem," but does not use the consumer's phone line.)

Tests of cable-based Internet access have already begun, but the service is still new and available only in limited areas. As of September 1996, according to a report in *Time*, "America's two largest cable operators, TCI and Time Warner, launched the nation's first commercial cable-modem services in Fremont, California, and Akron, Ohio, respectively."[37] Other locations are expected to follow soon.

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[36] Cable systems are designed to send large amounts of information to the consumer but need only receive small amounts back from the consumer. The connection is therefore not symmetrical.
[37] Michael Krantz, "Wired for Speed," *Time*, September 23, 1996, p. 54.

Cable-based Internet access might raise some interesting regulatory questions, as cable companies are regulated, but Internet access providers as such are not (although there are regulated companies, such as Pacific Telesis and AT&T, which also are or encompass Internet access providers). Exploration of such regulatory questions is beyond the scope of this paper, but could be addressed in a follow-up analysis.

Game Machines Meet the Web

In another example of the cross-pollination of technologies, video game maker Sega has announced a device to connect its game machines to the Internet. (A telephone connection is required.) This could provide another entry-level option for families that want to use the Web but do not want to buy a personal computer to do so. Like WebTV, the Sega device is an option that could start to demonstrate its viability in the market by January 1997. The device is to sell for around $450 (including the game machine itself), and requires an Internet access account. Sega has arrangements with Concentric, an Internet service provider, for accounts at $19.95 per month for users of the device. According to Sega's announcement, posted online:

> The Sega Saturn Net Link modem plugs into the cartridge slot on the Sega Saturn, providing an online connection to the Internet. Included with the modem is CD-based, HTML 2.0 compatible web browser software developed specifically for the NTSC TV display standard and offering a similar feature-set to Netscape 1.1 and other popular browsers currently in use.

In another venture, Atari and Chuck E. Cheese pizza chain founder Nolan Bushnell and partners have announced a system, to be installed in bars, restaurants, and similar locations, to link game-players via the Internet. Multi-player games could involve competing teams at one or many locations.

High-Tech Phones Offer Access the Internet

New telephones, on sale as of September 1996, will allow e-mail, financial transactions, and several other functions without a personal computer.[38] The phones include a small keyboard and a liquid-crystal display screen, making them the equivalent of a small, special purpose computer connected directly to the phone line.

Because e-mail is one of the most-used features of the Internet, even at a list price of around $300 such phones could quickly become widely used for that purpose. (They cannot yet receive e-mail, but that capacity is to be added within a year.) They also offer other features, such as caller identification, the ability to send text messages to pagers equipped to receive them, and a "cash card" slot to facilitate payments for goods and services.

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[38] David Elrich, "High-Tech Phones Give Home Computers a Run for Their Money," *New York Times*, September 5, 1996 (posted on *New York Times* Web site).

Connected Applications: Hybrids of Local and Remote Resources

A "connected application" combines information flowing over the Internet with information residing on the user's local computer. This approach can radically reduce the need to transmit data (especially large files such as graphic images). For example, one use of the Internet is to play games among a group of users at remote locations. If the images (scenery, room layouts, backgrounds), sound files, and text are stored on each player's local hard disk (or other appropriate storage and access device, such as a CD-ROM disk), then all that must be transmitted is coordinates or brief text entries.

If this technique were limited to games, it would be of relatively narrow interest. However, there is no reason why the same approach could not be used with commercial catalogs, maps, reference materials, educational resources, and other types of data. America Online and other commercial networks routinely store graphics on the user's machine rather than transmitting images online every time the user invokes a new function. (America Online is notorious for the frequency with which it adds artwork online, but once the files have been sent, they may be called up on the user's machine, saving time online and speeding responses.)

Intranets and Corporate Computing

The Internet and the software it runs on have in turn spawned "intranets." An intranet is an internal corporate version of the Internet, with a similar user interface (browser), and with protective "firewall" and a gateway to the Internet.[39] Microsoft, Netscape, Sun, and others are very interested in this market, and are actively seeking to make their software (and in Sun's case, also hardware) the standard for intranets.[40]

Unfortunately, vendor documents on intranets tend to argue the merits of their respective approaches and to be fogged in techno-babble. The essential point, though, is that the same sorts of tools that work on the Web can work within an organization to make its documents easily available to staff and to facilitate communications and in-house transactions.

By means of a link to the Internet (through appropriate security systems, as shown in simplified form in Figure 8), corporate intranet users also have access to the entire scope of the Internet *and* outsiders may be granted controlled access to corporate information.

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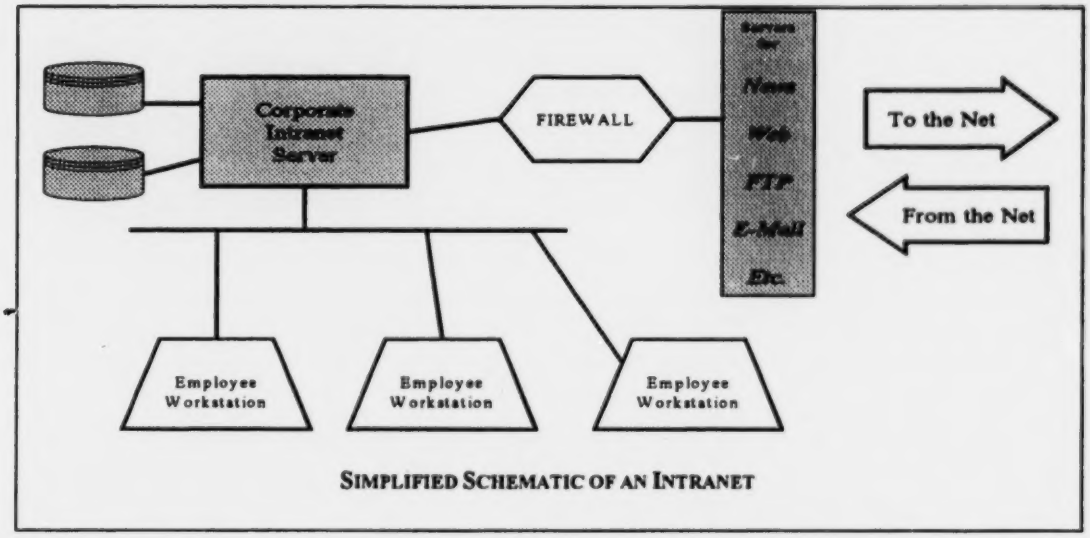
[39] A firewall is a system of hardware, software, or both that limits access between connected computer networks. Sometimes internetwork firewalls are called "proxy servers."

[40] Reportedly, profits in the browser business depend predominantly on these corporate intranet markets, not on individual users of Netscape, Microsoft Internet Explorer, and so on. For an extensive discussion of Intranets, see Ryan Bernard, *Corporate Intranet: Create and Manage an Internal Web for Your Organization* (N.Y.: John Wiley & Sons, 1996). In June 1996, both Microsoft and Netscape both posted white papers on their intranet strategies on their respective Web sites.

Standard software and protocols allow a seamless integration between internal and external sites.

Figure 8



SIMPLIFIED SCHEMATIC OF AN INTRANET

This is a growth area, and one that can be adapted to use by any organization large enough to have its own internal network(s) and with a need to communicate with the Internet in either or both directions. Despite its current domination of the Internet browser market, much, if not most, of Netscape's business is in the corporate intranet market, and the company is refocusing its efforts to concentrate there.[41]

Pileups on the Information Superhighway

All of the other issues discussed here become moot if access becomes so constipated as to render the Internet useless. Liken the experience to a traffic light that never turns green and allows no way around. If the traffic light is at the end of your driveway, driving ceases to be an option. (More accurately, the red light would likely be at the driveway to your cyberspace *destination* across the country or at an overcrowded interchange en route. The effect would be the same: you are not going anywhere.)

Sources of Congestion

- More hosts and more users.
- More high-bandwidth uses, especially sound and video.

[41] Robert E. Calem, "Netscape Unveils Its New Internet Suites," *New York Times* (online edition), October 16, 1996.

- Overworked routers and DNS servers.

- Growth in junk e-mail--commercial, advocacy, pranks, and chain letters.

- Lack of incentive to limit or set priorities on use, as access is often not metered and flat-rate services do not encourage conservation of bandwidth.

An indirectly related issue resulting from expansion of the Internet is a looming shortage of domain names and of IP addresses, the numerical addresses that uniquely identify each computer on the Internet, as a phone number uniquely identifies a particular customer's account. Steps are underway to alleviate these problems.[42]

Are there Solutions?

Some aspects of the congestion problem can be solved, and some cannot. There has even been a vigorous debate over whether there *is* a bandwidth shortage (currently or just around the corner). One industry analyst predicted that Atlanta Olympics-related traffic on the Internet would cause online gridlock. The prediction proved false. Experience online nonetheless demonstrates that congestion is real and that it appears to be getting worse. At the same time, it is not nearly as serious as one would have expected from the phenomenal growth in Internet hosts, content, and users over the past two or three years.

It is critical to bear in mind that no matter how great the capacity of the Internet as a whole is, a popular site may be overwhelmed and inaccessible to most people trying to access it at a given time. *That is a reflection of limitations at that site*, not of the Internet as a whole. At the same time, however, even if specific sites are managing ok, if the total volume of traffic on the Net becomes large enough (millions of users accessing millions of hosts), bandwidth, routers, and DNS may be swamped. One person may be experiencing a system congestion problem while another is simply trying unsuccessfully to access one heavily used site. The results will look the same to the user, but the problems are fundamentally different.

Approaches to dealing with congestion cover a wide range, including purely technical data-handling methods, economics-oriented proposals for congestion pricing or priority tagging, and the building of alternative networks. As government increasingly makes use of the Internet to provide information and services, congestion increasingly is a matter of direct public concern.

[42] An even more distantly related, although not trivial, issue is the shortage of telephone numbers as more and more households acquire second phone lines for modem use. The growth in second lines for modems comes on top of increasing need for phone numbers for cellular phones, fax machines, and growing numbers of households and businesses.

Some methods that have been used or proposed follow:

- Data compression reduces the number of bits a message requires without losing necessary information, stretching available bandwidth. Some types of files can be compressed by a large factor (as much as 27:1 in the case of video, for example[43]). Compression can be accomplished in software and in hardware and at various levels in the system, including by modems that support data compression.[44]

- Installation of higher bandwidth backbones and of additional backbones.

- Use of faster routers and of high-speed switches.

- "Caching" of popular web sites on local servers (so that the data need not be retrieved again from the original source) and use of "mirror" sites that replicate often-used resources at alternative locations.

- Congestion pricing. Variations on this theme have been proposed or discussed by Jeffrey MacKie-Mason, Hal Varian, and others, but so far none appears to be practical to implement.[45] The question of congestion pricing encompasses complex questions of both economics and technology, and is beyond the scope of this paper. The central point, though, is that congestion would be reduced and bandwidth allocated more efficiently (from an economic point of view) if use of bandwidth were priced in proportion to congestion. Higher prices during congested periods would tend to change behavior so that low-value uses would be reduced or deferred in favor of high-value uses. Each user could, of course, determine what is of high or low value to him or her and when.

- Priority tagging of data packets. Cisco Systems has announced "Tag Switching technology," a hardware-based means of differentiating among data packets on the basis of priorities. The technology is not in use yet, but appears to be part of Cisco's strategic plans.[46]

Other technical developments promise increased bandwidth. These include asynchronous transfer mode (ATM), frame relay, Asynchronous Digital Subscriber Loop (ADSL), and Integrated Services Digital Network (ISDN). The *Cyber Dictionary* flatly asserts that

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[43] Bill Gates, *The Road Ahead* (New York: Viking, 1995), p. 30.

[44] See Shnier, *Dictionary of PC Hardware and Data Communications Terms*, for definitions and brief explanations of many compression-related terms and techniques.

[45] See, for example, Jeffrey MacKie-Mason and Hal Varian, "Some Economics of the Internet," paper prepared for the Tenth Michigan Public Utility Conference at Western Michigan University, March 25-27, 1993. Version posted on line dated February 17, 1994. Also, MacKie-Mason and Varian, "Pricing the Internet," prepared for the conference "Public Access to the Internet," JFK School of Government, May 26-27, 1993. Version posted on line dated February 10, 1994.

[46] See Cisco's September 1996 white paper, "Scaling the Internet with Tag Switching," posted at http://www.cisco.com.

ATM "will be the basis for most telecommunications by 1997." It is an international standard designed from the ground up to carry data, voice, and video, to allow different types of system to communicate, and to serve networks of all sizes and scopes. Detailed discussion of these technologies is beyond the scope of this paper, but Kalakota and Whinston provide a summary.[47] The essential point is that the telecommunications technology underlying the Internet is evolving rapidly and dramatically in directions that could not have been predicted only a few years ago, driven by international commercial interests.

Is the Internet Boom Headed for Collapse?

Cynics may suggest that the Internet is like citizens' band radio, a fad that shoots to prominence, peaks, then declines to a steady-state, obscure utility level. In a recent letter to *Time* magazine, one person summarized that view:

> This whole computer/internet thing leaves me a bit mystified. Aside from a very few niche applications in business and certain of the sciences, of what practical use are computers or the Internet? The minor applications in business and research are valuable, but otherwise computers look to me like nothing more than expensive toys--Barbie dolls for spoiled and bored grownups--and the Internet browser programs look suspiciously like this year's dresses for Barbie.[48]

Given the explosive growth of the Internet, especially its Worldwide Web aspect, and given the large commercial enterprises with a stake in it, collapse of the Internet's popularity and growth looks unlikely now. But then, the collapse of the CB boom looked unlikely, too. What, then, might lead to a similar implosion for the Internet?

- Using it is too difficult and confusing for many potential users. Computers, even personal computers, can be cranky, confusing, and hard to use. To connect with the Internet, people not already used to a PC have to overcome the hurdles of using a PC in the first place *and* the hurdles of installing Internet access software and getting it to work. Even using a keyboard and mouse, not to mention navigating Windows, presents a challenge.

- Loss of novelty. Net surfing might simply become passé as it becomes more and more familiar to more and more people. But on the other hand, television is not novel yet remains a medium that, while changing, is entrenched and ubiquitous. The major commercial television *networks* may be losing market share, but that does not mean that the medium itself is going away. The question then is, is the Internet, as it is now established and developing, merely a novelty item with only transient entertainment value? Or does it involve much more than that, activities with more permanence? The

[47] *Frontiers of Electronic Commerce*, Chapter 19, "Broadband Communications." This may be the best currently available summary.
[48] Marty Meltzer, Morton Grove, Illinois, letter to editor, *Time*, October 7, 1996, p. 4.

burgeoning numbers of sites and capabilities devoted to valuable information and services, communications, and commerce of all types suggest that the Internet is here to stay, even as the "market share" of its original applications shrinks.

- Using the Internet is too slow. The online experience can be tedious and therefore unrewarding. As a result, growth in the number of users could slow and eventually come to a halt.

- Regulatory strangulation. If Internet access providers, businesses online, backbone providers, and others involved in the system face excessive hurdles, growth could be slowed.

- Digital sabotage. Malicious hackers have repeatedly demonstrated that they can shut down Internet providers, delete thousands of posted messages with "cancelbots," and vandalize Web sites. If these sorts of activities become common, they could discourage and drive away users of the Internet at all levels, from individuals to corporations.

- High costs of access and use. Unless access becomes less costly (not requiring a $1,500 to $2,000 PC and not running up large monthly fees and possibly requiring a second phone line), the pool of people willing to pay for access will be exhausted.

- Unreliability for sensitive or critical applications. If the Internet simply cannot be made reliable for transactions requiring timeliness, security, and confidentiality, then its attractiveness will shrink.

- Failure of businesses to make a profit via the Internet. Many businesses have made money *from* the Internet (selling hardware, software, consulting services, access, and so on), but it is not clear that many have made money *on* the Internet. Ultimately, Web sites must be shown to contribute to business profitability. If that does not happen, the movement toward online commerce will come to a halt.

- Shortage of techno-nerds. Continuing growth in use of the Internet requires technicians at all levels. Small companies wishing to go online must either have in-house expertise or contract with a service to provide that expertise (setting up a Web site, for example). Companies, agencies, and individuals all need to get their hardware and software installed and running, even for simple access to the Internet for information and e-mail. At the rate Internet hosts and users have been increasing, technicians may be in short supply, at least for a time, slowing further growth.

- Too many choices. There may be a risk of consumers entering mental gridlock when faced with choices among Internet-access from cable companies, telcos, numerous local and regional ISPs, value-added proprietary providers, wireless systems, and others yet to be announced. The sensation may be not unlike that felt by the hapless

consumer surrounded by legions of car salesman at an auto mega-mall, a panic leading to flight.

The other side of all of these issues is that countless businesses, government agencies, educational institutions, organizations, and individuals have an interest in continuing the success and growth of the Internet. Some want to use it to provide information, some to sell goods and services online, and some to sell Internet equipment and software at all levels. The more it does succeed, the more incentive there will be to make access easier and more widespread and the more people there will be with the ability to do so.

In whose interest is it to ease access to the Net?

- Government agencies that want to put information and services online.
- Businesses looking for customers online.
- Educators who see that students benefit from information online.
- Publishers who want to benefit from paperless, inventoryless online systems.
- Tourist destinations (chambers of commerce, local attractions, hotels and motels, and so on) as they seek to reach travelers and vacationers.
- Travelers and tourists looking for help to choose destinations, arrange accommodations, and pick travel routes and methods.
- Librarians and library patrons making use of books, magazines, newspapers, and documents online.
- Environmentalists who see pollution reductions and resource savings made possible by online communications.
- Employers posting job notices, communicating with employees, and setting up telecommuting programs.
- Real estate agents advertising or looking for properties.
- Providers of Internet access services, who wish to have as large a clientele as possible.
- Producers of Internet-related hardware and software, who seek to enlarge their market.

In short, an enormous range of individuals and organizations share an interest in making Internet access widely and easily available. For that reason it seems improbable that

access could long remain too slow or too difficult. Too many people and institutions have incentives and abilities to fix the problems.

In other words, *market pressures and opportunities will work to make access to the Internet widely and inexpensively available.*

In the future, everyone will have a Web site

Well, maybe not everyone--but perhaps as many people and organizations as now have telephone listings, advertisements in newspapers and magazines, and listings in professional society rosters and "who's who" lists. As e-mail becomes an increasingly common way to reach people, and as the Internet becomes increasingly common as a way of finding information, personal Web pages will become increasingly accepted as a way of making available that information people wish to be public, including hobbies and interests, résumés, organizational memberships, and business information. This *could* require a lengthy transition--a generation or more--but could also happen much more rapidly, at least among a large part of the U.S. population.

In time, e-mail will become as common as today's physical, paper mail services, called "snail mail," by Internet users, and will develop comparable alternative delivery systems. It is not difficult to envision a chain of "E-Mail Boxes, Etc." stores for those who want privacy, prefer not to clutter their home or business e-mail boxes with some kinds of correspondence, are on the road, or otherwise need an alternative or an extra e-mail account.

Little by little, communications via the Internet, or whatever a successor system may be called, will become as routine as the telephone, television, and fax machine are today--and all of those were new and unknown technologies not very long ago.

This chapter has outlined what the Internet is and where it came from, how it works, the kinds of information it encompasses, how the Internet relates to the telephone system, and changing methods of access. The next chapter looks at commerce on the Internet and some of the issues related to Internet-based business.

CHAPTER 2: COMMERCE ON THE INTERNET

> "Within a few years, the digital document, complete with authenticatable digital signatures, will be the original, and paper printouts will be secondary." (Bill Gates, *The Road Ahead*, 1995.)
>
> "It will take at least a half a century for customer use of electronic money and banking to become commonplace, the chairman of Citicorp said Thursday [September 19, 1996]." (Reuter Information Service report, September 20, 1996.)

Commerce is now the driving force behind the Internet's continuing growth, especially its Worldwide Web aspect. Everything except physical goods can be delivered across communications lines in the form of digital information. Much commerce is just the exchange of information, which makes the Internet an ideal means for conducting business. Although physical goods cannot be sent over the wires, information vital to design, production, selection, sale, purchase, and delivery of such goods certainly can be. You cannot send groceries over the Internet, but at least in Manhattan and in Los Angeles you can order them online for next-day delivery.[49]

Businesses of many types are already on the Web, sometimes selling directly and sometimes just providing information on products that may be purchased by other means. Advertising appears on increasing numbers of sites, and hyperlinks quickly bring Web users to vendors' own Web pages. While the Web has reportedly not yet proven profitable to many companies, the technology is still in its infancy as a means of doing business.

During the 1996 Summer Olympics, Web addresses appeared in small print on many televised advertisements, in contrast to none whatsoever in any previous Olympics. This is a harbinger of things to come, where advertising is integrated across the spectrum, from print to broadcast to Internet. Once TV broadcasts are themselves coordinated with the Internet and viewers may navigate on screen to an advertiser's site, the integration of the technologies will become complete: *The sprinters perform. Reebok (or Nike, or whoever) runs a spot promoting its running shoes and other athletic gear. The viewer clicks on an icon to visit a virtual sales floor for the promoted merchandise, examines the choices, and enters an order on the spot. The order is transmitted instantly to the local dealer, who in turn delivers the merchandise to the purchaser's door or has it ready for pickup at a nearby store.*

The Internet, and especially its Web component, is beginning to have a significant impact on the conduct of some types of business. For example, the ability to post real estate information on the Web is offering some competition to the Multiple Listing Service, a

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[49] Katherine Cavenaugh, "Grocery Shopping Online in Manhattan," *New York Times* (online edition), September 4, 1996. In Los Angeles, Kroger's has an online grocery shopping site, with a link from the *Los Angeles Times*'s Web site as of mid-September 1996.

system to which only fee-paying Realtors[50] have access. Real estate companies are posting their own Web pages and individual home owners can post information that is then freely available to anyone with Web access. (Real estate mega-firm Coldwell Banker has a Web site that it advertises on the radio.) It is only reasonable to expect Web-based businesses to spring up specifically to facilitate listing of properties online and to act as a central directory of many property listings, even to facilitate "by-owner" sales. Similar enterprise may be expected in other areas where the Internet may be used to get buyers and sellers together outside of previously established methods and institutions.

In evaluating the commercial potential of the Internet, one group of researchers concluded:

> The Internet, especially that portion known as the World Wide Web, has the potential to radically change the way businesses interact with their customers. The Web frees customers from their traditionally passive role as receivers of marketing communications, gives them much greater control over the information search and acquisition process, and allows them to become active participants in the marketing process.[51]

The opportunities offered by these changing roles can be expected to multiply as use of Internet grows in number of participants and in the types of transactions in which those participants engage. So far, consumers have been reluctant to make purchases online, but this can be expected to change as payment methods become easier and more secure, as consumers become more familiar and comfortable with the technology, and as more consumers have Internet access.

At this time, there is little indication of the Internet yet proving profitable to online businesses. David C. Churbuck, writing in *Forbes*, asked, "where is the flood of spending money this great phenomenon [the Internet] was supposed to unleash?" He adds, "as a way to move merchandise, it has not proven itself and probably won't for a long time."[52] That article appeared two years ago, though, and much has happened since then, both in terms of increasing numbers of Internet users and in terms of mechanisms for merchandising online. The potential for profitability may be growing faster than the author expected. More recent reports, however, are not wildly encouraging, at least for the near term:

> Thousands of companies have set up electronic storefronts on the World Wide Web with hopes of luring customers from around the globe. But precious few have produced a profit, while the vast majority of Web sites

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[50] "Realtor" is a trademark for a member of the National Association of Realtors, and is not synonymous with the generic term "real estate agent."

[51] Donna L. Hoffman, Thomas P. Novak, and Patrali Chatterjee, "Commercial Scenarios for the Web: Opportunities and Challenges," JCMC, Vol. 1, No. 3 (posted at http://shum.huji.ac.il/jcmc/vol1/issue3/-hoffman.html, downloaded October 10, 1996), p. 17.

[52] "Where's the Money?" *Forbes*, January 30, 1995 (as posted on line).

> are still spilling red ink. Most of these efforts lack the financial resources of Microsoft [which is reported to be ready to lose substantial sums of money on its Internet activities, following losses already running into the hundreds of millions of dollars].[53]

The issues surrounding online commerce are of concern not only to business, but also to government, as government increasingly conducts business online. The California Department of Information Technology (DOIT) briefly addressed electronic commerce in its July 1996 *Interim Annual Report*:

> The ability to provide information, benefits, and services electronically, without direct, personal contact has revolutionary implications not only for business, but perhaps to an even greater extent [for] government. Virtually any government activity that involves filling out a form, registering, paying, receiving benefits, or supplying information can be done effectively, and significantly more inexpensively, through electronic means. As a result, the DOIT is working with several agencies to aggressively pursue electronic government opportunities.
>
> Currently, hundreds of thousands of individuals and organizations receive paper checks/warrants, benefit coupons, etc., each day from the state. As a result, in conjunction with the Treasurer's Office and the Office of the State Controller, the DOIT is preparing to initiate a pilot in early FY 96-97 to transform this process into an electronic one, substituting electronic payment for the paper-based system.
>
> The DOIT anticipates that this procedure will become ubiquitous, as electronic benefits transfer, electronic data interchange, and other forms of electronic commerce begin to predominate in state government, saving millions of taxpayer dollars.[54]

It seems reasonable to expect that the State of California and local governments in California will begin to purchase supplies and services online as the techniques and opportunities for doing so progress and as online purchasing becomes an efficient and reliable option. However, several issues must be faced before online purchasing becomes the norm.

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[53] Jared Sandberg, "Microsoft Plans to Spend Big on the Internet," *Wall Street Journal*, November 15, 1996, p. B9.

[54] California Department of Information Technology, *Interim Annual Report: Reforming the State of California's Use and Management of Information Technology* (Sacramento: the Department, July 1996), p. 27.

General Requirements of Electronic Commerce

There are several requirements for online commerce, applicable to all kinds of transactions, not just those directly involving payment, and not just pertinent to the Internet. These include authenticity, integrity, nonrepudiation, writing and signature, and confidentiality.[55]

Authenticity has been defined as being ". . . concerned with the source or origin of a communication. Who is the message from? Is it genuine or a forgery?" Authenticity is necessary for the conduct of business. The Internet does not change that fact, but does create new ways in which authenticity might be compromised or require proof. Knowledgeable computer users can and do send messages that purport to be from another party, a process called "spoofing."

Integrity, too, is vital to business, and "is concerned with the accuracy and completeness of the communication. Is the communication the recipient received the same as the communication that the sender sent? Is it complete? Has the communication been altered either in transmission or in storage?" Electronic methods introduce possibilities for alteration of messages that differ from those previously known. A communication on paper can be altered, but is likely to show some marks of having been altered, such as erasure marks. A purely digital message, however, may be altered with no indication of the change having been made. Use of the Internet expands the potential threats to communications integrity, as insecure systems may be hacked by outsiders and data files altered blatantly or subtly.

Nonrepudiation is intimately related to authenticity and integrity. It "is concerned with holding the sender to his or her communication. The sender should not be able to deny having sent the communication if he or she did, in fact, send it, or to claim that the contents of the communication as received are not the same as what the sender sent if, in fact, they are what was sent."

The law may require that transactions be *in writing and signed*. For example, "federal, state, and local governments . . . require that certain transactions [such as contracts] be signed and in writing . . . before the government will consider itself bound." But in the world of digital communications, what constitutes a written, signed document?

Finally, *confidentiality* "is concerned with controlling the disclosure of information." Although sometimes confidentiality is not an issue, other times it is critical. Confidentiality is somewhat separate from the other issues, as a non-confidential communication (one that has been intercepted and read by a third party) might still meet standards of authenticity, integrity, nonrepudiation, and writing-and-signature. Likewise, a commu-

[55] This list follows Thomas J. Smedinghoff, editor, *Online Law: The SPA's Legal Guide to Doing Business on the Internet* (Reading, Massachusetts: Addison-Wesley, 1996), Chapter 3.1. Quoted passages in this section, if not otherwise identified, are from *Online Law*, Chapter 3.1.

nication might be kept confidential, but nonetheless be inauthentic or of compromised integrity, subject to repudiation, or lacking verified and accepted signature.

If the problems of authenticity and integrity are solved, and if an accepted method is devised for treating digital documents as written and signed, then the nonrepudiation issue would seem to be solved as well, or at least as well as for comparably secure paper documents. The question then becomes, *how may digital documents be proven authentic, assured of integrity, and affixed with the digital equivalent of a signature?* For the sake of discussion, let us assume that settling those three matters also settles the matter of the communication being "in writing." A more detailed analysis of that specific point is beyond the scope of this paper.

Digital Signatures

A "digital signature" is *not* a digital representation of a handwritten signature. Nor is a digital signature the same from one document to another even if issued by the same individual. Rather, a digital signature is based on the specific document *and* on a unique key assigned to the individual. That is, the digital signature is tied to the particular person and the particular document. Any change in the document invalidates the signature and requires that a new one be generated for the revised document, but again one reflecting the individual's unique key.

The concept is summarized in *Online Law*:

> Before a sender can digitally sign an electronic communication, the sender must first create a public-private key pair. The private key is kept confidential by the sender and is used for the purpose of creating digital signatures. The public key is disclosed generally by posting the key in online databases, repositories, or anywhere else the recipient of the digitally signed communication can access it.
>
> To digitally sign an electronic communication, the sender runs a computer program that creates a message digest (or hash value) of that communication. The program then encrypts the resulting message digest using the sender's private key. The encrypted message digest is the digital signature. The sender then attaches the digital signature to the communication and sends both to the intended recipient.[56]

A "message digest" is a string of characters generated (maybe "calculated" is a better term for the process) by the digital signature software. The string of characters appears meaningless, but the software can evaluate the string and compare it to the message and

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[56] Smedinghoff, *Online Law*, p. 45. Also see Ravi Kalakota and Andrew B. Whinston, *Frontiers of Electronic* Commerce (Reading, Massachusetts: Addison-Wesley, 1996), pp. 202-3, and Benjamin Wright, *The Law of Electronic Commerce*, Second Edition (Boston: Little, Brown, 1996), §16.7.3.

the public key to determine whether the message has been altered since the digital signature was generated.

The system works because the sender's public key (and *only* the sender's public key) can decrypt a digital signature that has been encrypted with the sender's private key.[57] The sender's private key remains private. The sender cannot repudiate a secure, digitally signed document.[58]

Wyoming, California, and Utah have digital signature laws, and a committee of the American Bar Association has drafted guidelines for digital signatures. The Wyoming law authorizes the Secretary of State to accept electronically signed documents, but leaves the selection of methods up to that office.[59] The California law (Chapter 594, Statutes of 1995, AB 1577, Bowen) defines a digital signature, authorizes their use in communications with public entities, and requires the Secretary of State to adopt regulations not later than January 1, 1997. The Utah law "is more specific, more ambitious, and much more complex . . . [as it] singled out a particular electronic technology, and said that if the technology were used in limited and particular ways, then certain legal results [pertaining to all types of electronic messages] would follow." In addition, "Utah chose to regulate use of the technology, even use that has no direct relevance to the administration of state government."[60]

Online Payment Systems

A key problem in online commerce is *means of payment*. There must be a way to assure that the payment is valid (authentication), to prevent fraud by merchants or their staffs, and to secure financial information, such as credit card numbers, from unauthorized access. This has been, and will continue to be, an area of vast and varied activity, with many players involved in developing and implementing payment systems. This section will only attempt an overview of some mechanisms now in use or under development and of the sorts of issues that must be addressed.

Government agencies charge for some information and collect fees for some services (for example, park reservations). Once the technical obstacles and security concerns are overcome, tax returns could be filed via the Internet and amounts due collected or refunds provided through electronic fund transfers. (Tax returns can now be filed electronically, a service that many tax-preparers provide, but the filing is not done via the Internet.) Even if government is not involved in the creation of online payment methods and establishment of other standards for commerce, it does have an interest in the efficiency and security of those methods (and in understanding how they may be used) in order to conduct its own affairs in an increasingly Internet-dependent world.

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[57] For an explanation of encryption, see Daniel C. Lynch and Leslie Lundquist, *Digital Money* (N.Y.: John Wiley and Sons, 1996), especially Chapter 3.
[58] Kalakota and Whinston, p. 202.
[59] Wright, §16.7.3.
[60] Wright, §16.7.3.

Some concepts important to online payment systems are secure protocols, digital cash, and smart cards.

Secure Protocols

Packets sent on the Internet may be intercepted, and therefore are not secure without special precautions. Concern over theft of credit card numbers and other confidential information sent over the internet has led to a variety of methods to prevent snooping. One relatively low-tech method is for the customer to establish an account with the vendor by mail or over the telephone and then to place orders online with the understanding that the merchandise will be charged to the previously-established account. This addresses the problem of credit card security, but does nothing to prevent snooping into other aspects of the transaction.

One fully online approach is the "secure sockets layer" (SSL), a data security protocol proposed by Netscape Communications. SSL encrypts data going both directions and provides other security measures. The software on both ends of the transaction handles the encryption and decription. (That is, the Netscape browser program itself does some of the work.) In short, "SSL provides encryption that creates a secure channel to prevent third parties on the network from being able to tamper with and read messages being exchanged between the client and server and authentication that uses a digital signature to verify the legitimacy of the server."[61] A site may have *both* a secure and an insecure server, so a user can browse a catalog via the insecure server and then go to the secure server to place an order.

Another method is the Secure Hypertext Transfer Protocol, S-HTTP. (HTTP is the Internet protocol used to transfer documents on the Web.) S-HTTP's approach is to encrypt specific documents transmitted on the Web, while SSL instead encrypts the entire session. SSL and S-HTTP "address different pieces of the security puzzle," but are not incompatible.[62]

Netscape Navigator users may sometimes notice a small key icon in the lower left corner of the screen. A broken key indicates an insecure server, which is the normal case. When the browser has contacted a secure server, the broken key is replaced by a whole one, indicating a secure protocol. The browser then stops issuing warnings about possible interception of communications when the user completes a form and clicks on the "submit" button.

[61] Kalakota and Whinston, p. 247. Section 6.5 of this book (pp. 243-50) addresses security on the Web.
[62] Kalakota and Whinston, p. 249.

Digital Money

Digital money may take two basic forms.[63] One is a computer data file that holds a store of value. That value may be spent, and as a portion is spent, it is deducted from the total value of the file. I will refer to that system as "digital cash" here for convenience. The other basic form is a "smart card," a wallet-size card encoded with the value it holds, and used in a manner somewhat comparable to an automated teller machine card. Pre-paid phone cards are a special-purpose smart card.

Daniel Lynch and Leslie Lundquist summarize the "guiding principles of digital money" this way:[64]

- It must be independent from any single physical location
- It must be secure--not reusable
- It must be private--that is, untraceable, just like coins and Federal Reserve Notes
- It must be usable off line as well as online
- It must be transferable to others
- It must be divisible into smaller amounts, so that the whole amount need not be spent in one transaction

Many companies are involved in the field of digital money and other online payment systems. (Some deal in debit systems that draw funds from a bank account, not in "digital money" as defined here.) Not all of them meet all of the listed requirements, and each emphasizes particular features or benefits. These companies include Checkfree, Cyber-Cash, DigiCash, First Virtual, NetBill, Netscape, and Open Market, Inc. (OMI).[65]

It is difficult to draw a clear line between smart cards and digital cash, especially as smart card readers connected to PCs or set-top boxes will allow them to be used for online payment. Both types of digital money will serve the same purpose, to allow payment without the use of credit cards, checks, or checking accounts. At this time, it is not possible to predict which company or companies--or even which systems--will prevail in the market. It does seem likely that ultimately some combination of systems, provided by many companies, will find a niche, just as many kinds and vendors of credit cards and charge cards, checks, check cards, ATM cards, and merchant scrip, not to mention cash, all have a place today.

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[63] See the "Electronic Payment Schemes" page, http://www.w3.org/pub/WWW/Payments/roadmap.html, for extensive information and links to those involved in this industry.

[64] This list is adapted and partly quoted from Lynch and Lundquist, pp. 109-110.

[65] Lynch and Lundquist, p. 37, Table 2.2. For a concise summary of each of these companies, see *ibid.*, especially at pp. 36-39

One of the potential benefits of digital money, especially when used on the Internet, is that it may help to avoid the complexities of currency exchange and to minimize the costs of conversions. Digital money could certainly make international purchases and sales easier and faster. While this prospect is promising to some, it may be threatening to others challenged by increased competition made easier by a borderless Internet.

The State will be directly affected by these technologies in many ways, as both purchaser and vendor of goods and services, and therefore has an interest in their costs, security, and functionality.

Taxation and the Internet

The Internet raises only one tax issue directly: the taxation of Internet access service itself. It does complicate others, however, and may have significant indirect impacts.[66]

The U.S. Department of the Treasury has summarized its view of tax policy and administration issues arising from new information and communication technologies, including electronic money:

> These new technologies . . . have effectively eliminated national borders on the information highway. As a result, cross-border transactions may run the risk that countries will claim inconsistent taxing jurisdictions, and that taxpayers will be subject to quixotic taxation. If these technologies are to achieve their maximum potential, rules that provide certainty and prevent double taxation are required.
>
> In order to ensure that these new technologies not be impeded, *the development of substantive tax policy and administration in this area should be guided by the principle of neutrality. Neutrality rejects the imposition of new or additional taxes on electronic transactions and instead simply requires that the tax system treat similar income equally, regardless of whether it is earned through electronic means or through existing channels of commerce.* [Emphasis added.]
>
> A major substantive issue raised by these new technologies is identifying the country or countries which have the jurisdiction to tax such income. It is necessary to clarify how existing concepts apply to persons

[66] On November 21, 1996, the U.S. Treasury Department announced "a draft report . . . that outlines the Clinton administration's opposition to new federal taxes on the Internet but underscores its determination that the global computer network not become a haven for tax evaders . . . the report would advocate an 'overarching goal of neutrality [treating transactions similarly whether they take place on or off the Internet],' at least on the federal level . . . ." ("U.S. Trying to Figure Out How to Tax Internet," *San Francisco Chronicle*, November 21, 1996, p. D1.) The draft has been posted for comment (see below), but came too late for review and analysis in this paper.

engaged in electronic commerce. In addition, transactions in cyberspace will likely accelerate the current trend to de-emphasize traditional concepts of source-based taxation, increasing the importance of residence-based taxation.

Another major category of issues involve the classification of income arising from transactions in digitized information, such as computer programs, books, music, or images. The distinction between royalty, sale of goods, and services income must be refined in light of the ease of transmitting and reproducing digitized information.

In the area of tax administration and compliance, electronic commerce may create new variations on old issues as well as new categories of issues. The major compliance issue posed by electronic commerce is the extent to which electronic money is analogous to cash and thus creates the potential for anonymous and untraceable transactions. Another significant category of issues involves identifying parties to communications and transactions utilizing these new technologies and verifying records when transactions are conducted electronically. However, developments in the science of encryption and related technologies may lead to systems that verify the identity of persons online and ensure the veracity of electronic documents.[67]

The key policy perspective in the report appears to be the support of neutrality between online (electronic) and other forms of commerce.

Taxes on Internet Access Services

As Internet access services grow, they are seen as a possible source of revenue by local governments, raising questions of who could tax what, how, and where, and with what effects.

The most-reported case of a tax on ISPs was in Tacoma, Washington.[68] Tacoma imposed a six percent tax on ISPs' service charges and sought a $72 annual city business license. These fees were to apply to all ISPs with customers in the city, not just those located in Tacoma. Within two months, the Tacoma City Council, under pressure from ISPs and local citizens, repealed the telecommunications tax as it applied to ISPs and agreed to refund taxes already paid. (The fate of the business license has not been reported in press stories about the tax and its repeal, but it appears unlikely that the city could enforce a license requirement or fee on providers not actually having a business location in Tacoma because it has no means by which to do so.)

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[67] U.S. Department of the Treasury, Office of Tax Policy, *Selected Tax Policy Implications of Global Electronic Commerce*, November 1996 (posted at http://www.ustreas.gov), Executive Summary, pp. 2-3.

[68] Reports on this issue have cited similar taxes in Texas, Tennessee, Pennsylvania, Connecticut, the District of Columbia, and Florida.

The simplest approach to an Internet access tax, an approach proposed in Florida, is a statewide excise tax on computer network subscription fees and usage charges. The proposed Florida rate is 7 percent. Florida would also tax gross receipts of Internet service providers at a rate of 2.5 percent "if the business is classified as a taxable telecommunications service."[69] The Florida Chamber of Commerce is campaigning against the proposed Internet taxes, arguing that telephone service is already taxed and that the proposed measure "sends a very negative signal to business seeking to expand in Florida . . . ."[70] A Chamber spokesman also reported concern over double taxation of the services and over the administrative burden imposed by the complexity of dealing with taxes on these services.[71]

The *practical* difficulty raised by a tax on Internet access services is that a state without such a tax could become a haven for ISPs that provide national access via POPs in other states. A spokesman for the Florida Chamber of Commerce stated that this exact issue had been raised in discussions of the proposed Florida taxes on ISPs.[72]

Final resolution of controversies in this area might require a Supreme Court decision as to the conditions under which states may tax Internet access services provided by out-of-state ISPs *or* federal legislation clarifying the entire subject and possibly preempting the right of states and localities to tax Internet access services.

The *political* difficulty raised by taxes on Internet access services is that Internet users can quickly communicate their opposition and mount an attack via the Internet on those who propose such taxes, as has happened in the cases of the city of Tacoma and the states of Florida and Texas.[73] That possibility, however, has not stopped several states from taxing Internet access services. Such taxes are reportedly imposed by Ohio,[74] Pennsylvania,[75]

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[69] Reported by Associated Press, February 17, 1996: "Florida to tax Internet service providers?", as posted at http://www.jbit.com/bow/bow_tax1.htm (downloaded October 28, 1996).

[70] Quoted from press release posted at http://www.flchamb.com/tsx.html.

[71] John Bussey, Florida Chamber of Commerce, personal communication, October 28, 1996.

[72] *Ibid.*

[73] As of February of 1996, a controversy had arisen in Texas as to "whether Texas Internet Service Providers are required to pay a direct tax assessment for the Telecommunications Infrastructure Fund. As it stands right now, almost every ISP in the state owes tax for 1995 plus 10% penalty." Source: "More TIF Tax Trouble for ISP and BBS," *Texas Telecommunications Journal*, February 29, 1996, as posted at http://www.telecommute.org/ttj.

[74] Ohio applies sales tax to internet access services used for business purposes, but not for personal use. A spokesman for the Tax Analysis section of Ohio Taxation Department stated that data on the amount raised by this tax is unavailable, but the amount is probably not large. (David M. Elzemeyer, personal communication, January 14, 1997.)

[75] Pennsylvania expanded its sales tax coverage to include all "computer services" (except those for banking, such as computerized account inquiries) in 1991; that category includes Internet access services (for both business and personal use) along with many other types of computer service. Because Internet access services are included in a broader category, specific figures for revenue raised by the sales tax on Internet access services are not available. (Joe Breen, Pennsylvania Revenue Department, personal communication, January 14, 1997.)

Connecticut,[76] Massachusetts, and the District of Columbia, in addition to the previously mentioned Florida and Texas.[77] New York has decided to exempt Internet access service fees from sales tax.[78]

Currently in California, Internet access services and other online services, such as those provided by Netcom or Internet Unlimited (Internet access) and America Online (value-added network services plus Internet access), are not subject to sales tax, nor is taxation of such services currently proposed or known to be under consideration by staff of the Board of Equalization.[79] The State could, however, extend the sales tax specifically to Internet access charges or impose an excise tax on those services, either directing the proceeds to the General Fund or earmarking them for specific purposes, such as support of information resources for underserved populations or State government use of the Internet as a medium for providing information and services to the public.

Sales Tax Liability: Where is a Business on the Web *Doing* Business?

Before the Worldwide Web, a business either had offices, sales floors, representatives, and so on in a state or it did not. If it did, then its sales to residents of the state were subject to state sales taxes (in states with a sales tax). Companies that only mailed catalogs into other states and took orders by mail or phone but that did not have a physical presence in the state argued that they were exempt from any obligation to collect sales taxes and remit them to the states whose residents bought merchandise. The states, however, argued that they were in fact entitled to sales tax revenues on such sales.

The "Quill Decision" (*Quill Corporation v. North Dakota*, 112 S. Ct. 1904 [1992]) addressed the issue of mail order sales:

> In Quill, the Supreme Court held that an out of state mail order seller that has no physical presence in the state and who merely mails catalogs into the state and fills orders by U.S. mail or common carrier is protected by the Commerce Clause from use tax collection obligations in the destination

[76] Internet access services are subject to sales tax in Connecticut under the broader category of computer services. No specific information is available on revenue raised by the tax as applied to Internet access services. (Susan Sherman, Connecticut Revenue and Services Department, personal communication, January 14, 1997.)

[77] Elizabeth Wise, "Nation's Tax Collectors Eye Internet," *San Jose Mercury News*, April 12, 1996, p. 1C, citing Scot Greirson, "a California lawyer specializing in on-line taxation." The report also, but incorrectly, cites New York as imposing sales tax on Internet access services.

[78] A January 12, 1997, article in the *New York Times* (online edition) reported that Internet access service fees are not currently taxed and are to be explicitly exempted from sales tax, after "a yearlong study by the state Department of Taxation and Finance." (Shannon McCaffrey, "New York Governor Declares Tax Exemption for Net Access.")

[79] Dennis Fox, California State Board of Equalization, personal communication, October 28, 1996.

> state. The court reaffirmed the holding of National Bellas Hess, Inc. v. Illinois Dept. of Revenue, 386 U.S. 753 (1967).[80]

But how should the "virtual sales floor" or the "virtual office" now made possible by the Worldwide Web be viewed? When anyone anywhere can connect to a company's Web site and conduct business online, *where is* that business located? Does accessibility via a Web site constitute a connection between the taxpayer and the taxing jurisdiction ("nexus")? Is a Web site the functional equivalent of physical presence in every state? Or is it only the functional equivalent of mailing catalogs into every state? These questions, sooner or later, may have to be settled by the Supreme Court, as the Quill decision predated the Worldwide Web as a business medium and does not explicitly address the questions raised by Web-based catalog shopping.

U.S. Senator Dale Bumpers introduced the "Consumer and Mainstreet Protection Act of 1995," S. 545, to address this issue by mandating payment of sales and use taxes under specified circumstances. Those circumstances would have applied to large national catalog retailers that now, under the Supreme Court's Quill decision, do not pay such taxes except in states where they have a physical presence. The bill languished in the Senate Finance Committee, never reaching a vote.[81]

The potential stakes in the sales tax battle are large, both for businesses and for taxing jurisdictions. One analysis suggested that in 1994 California lost nearly a half-billion dollars of sales taxes on mail order sales (out of a national total of about 3.3 billion dollars of taxes lost on such sales).[82] The analysis notes that "These two trends, more out-of-state sales [due in part to the Internet] and a greater dependence by local governments on sales taxes, are now on a collision course."[83] The author concludes:

> The reality is that the rise of national and global commerce calls for national and even global solutions, regulations and revenue sources. While much rhetoric around the new technologies hearkens to images of small firms and decentralization, the reality is of rising billion-dollar and soon-to-be trillion dollar corporations straddling the globe. To expect local governments to devise fair and efficient systems of taxation with such a disparity in power is senseless.[84]

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[80] "1992 Bellsouth Tax Conference, State Tax Update," Charles R. Beaudrot, Jr., Morris, Manning & Martin. Posted at http://www.com/mmm/mmmStateTax.html.

[81] Bill Summary and Status Report, S. 545, via http://thomas.loc.gov, September 25, 1996.

[82] This is about 2.8 percent of the approximately $17 billion in sales and use taxes collected in California that year.

[83] Nathan Newman, "Prop 13 Meets the Internet: How State and Local Government Finances are Becoming Road Kill on the Information Superhighway" (Berkeley: Center for Community Economic Research, UC Berkeley, August 1995; posted on line at the Software Industry site), p. 7. Newman cites figures from the U.S. Advisory Commission on Intergovernmental Relations.

[84] Newman, "Prop 13," p. 17.

Another analysis emphasizes California's risk from out-of-state mail order and Internet sales:

> Ironically, the state most severely hit by the move to catalog and online shopping is California--home to many of the companies and universities that invented the technology that makes the Internet possible. Because of Proposition 13, which limits California's ability to raise money through property taxes, towns and cities are extremely dependent on sales taxes. Cupertino, for example, where Apple Computer has its headquarters, depends on sales taxes for 45 percent of all city revenues, prompting mayor Wally Dean to call the sales-tax dependence "a house of cards for government finances."[85]

Clearly this is an area in transition, and one that will not become easier if online commerce grows substantially and stimulates a large shift from in-state sales to untaxed interstate sales.

Income Tax and the Web

Does every state have a potential claim to *income* tax from a business on the Web? Each would if the business had an office, warehouse, or employees or other representatives in the state. Each also would if the company "Is doing business in the state," and this does *not* require physical presence, although "rules about what activity will create sufficient nexus vary depending on whether goods or services are being sold."[86]

Although the Internet does not itself create new questions about liability for *individual* state income taxes, it does seem likely to exacerbate existing questions and issues. Could a person in an income-tax-free state work for a company in California, conduct all transactions online, be paid in some form of digital cash, and thereby avoid all state income tax? Could he or she do so as a practical matter only? Or do so legally? Does the use of online communications make any fundamental change from communications conducted by telephone and mail services? These questions will assume real significance only if interstate work and payment becomes common and if the technique is exploited as a means of avoiding or evading tax liability. As long as the practice is rare, not used for tax avoidance or evasion, or both, then it raises no important issue.

Definitions and practices regarding taxes and their applicability vary from state to state, and circumstances come in an enormous variety. Neither a full analysis of tax issues nor a state-by-state comparison can be attempted in this paper.[87] The essential point, and one

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[85] Nathan Newman, "The Great Internet Tax Drain," *Technology Review*, May/June 1996, as posted on line at http://web.mit.edu/afs/athena/org/t/techreview/www/articles/mj96/.
[86] Smedinghoff, *Online Law*, p. 382-3.
[87] There is a Web site devoted to state taxes on electronic commerce (from a software industry perspective): http://www.SoftwareIndustry.org/issues/lec-sttx.html.

that may require a follow-up paper to explore, is that the area is complex, full of conflicts, and highly unsettled. The entire area will bear watching.

Business and Professional Licensure and Certification

Many professions are subject to state licensure and certification. In California, these include:

- Lawyers
- Physicians
- Nurses
- Pharmacists
- Psychologists
- Dentists
- Funeral directors and embalmers
- Geologists and geophysicists
- Landscape architects
- Speech and language pathologists
- Structural pest control operators
- Veterinarians
- Accountants
- Architects
- Barbers and cosmetologists
- Contractors

Many of these fields are unlikely candidates for competition over the Internet. Barbers and dentists probably have little to fear (or to gain, for that matter) from the technology. Others fields, however, might well be practiced online, crossing state or even national lines

at will, raising potential questions of licensure and regulation. These fields certainly could include law, accounting, architecture, psychology, and at least some aspects of medicine.

Competition with Local Businesses

Local businesses will increasingly face competition from cyberspace-based businesses, with impacts that cannot readily be determined. While this does not appear to affect government directly, it certainly could have indirect effects if the state or local economy is challenged as a result of Web-based competition. Some of the competition might come from businesses in the same metropolitan area, some from businesses elsewhere in the state, and some from businesses across the country or in foreign nations, depending on the types of products and services involved.

Some types of business (automotive repair shops, pizza parlors, barbershops, plumbing repair businesses, and so on) that provide hands-on service direct to the customer are unlikely to be affected by non-local competitors on the Web. You still cannot download a pizza or a haircut. Other types of businesses (book dealers, clothing stores, hobby and crafts suppliers, and so on) may face stiff competition from entrepreneurs who need not provide a storefront and might even be able to avoid significant inventory costs and sales taxes. These kinds of goods can be shipped to the purchaser in response to orders placed online, and online catalogs and "digital cash" mechanisms will facilitate selection and payment.

Sellers of big-ticket items, such as automobiles, boats, and possibly even major appliances, might be affected by Web-based competition or Web-based comparison shopping services. This could certainly be the case in regions where it is feasible for the products to be delivered economically or for customers to go to where the best deal is.

Fraud

According to the National Fraud Information Center:

> Fraudulent commercial activity on the Internet and "online" services is not yet a major problem. However, as use of the Internet expands, there is certain to be a major increase in deceptive and misleading promotions, bogus travel offers, contests, lotteries, and other illegal practices.[88]

The Internet, because of its dispersed nature and frequent lack of known physical addresses for individuals and businesses online, could become a haven for fraud of many types. Some evidence of that has appeared already, although Internet-based fraud is still dwarfed by the traditional types pursued through telephone, mail, and in-person solicitation.

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[88] National Fraud Information Center, http://www.fraud.org/tips.htm, October 30, 1996.

The CyberCop Precinct House, an online anti-fraud effort of the Internet Consumer Action Center (which uses the acronym ICAN in its postings, not ICAC), sees more of a current threat than does the National Fraud Information Center:

> The Internet is developing a reputation as the commercial equivalent to an early American western frontier town with few rules and no sheriff to keep the peace. Until now, cyber-citizens have kept order through mutual trust, integrity and self-help when necessary. This approach worked when the Internet was a small community of like-minded individuals.
>
> Today, however, the Internet has grown into a sprawling, rowdy boom town, complete with virtual shopping malls, traffic congestion, e-pollution, and, yes, superhighway-robbers who victimize Internet travelers. Most vulnerable are the growing numbers of new travelers, including many men[,] women[,] and children with little or no online experience.
>
> . . . In addition to well-publicized offenses like defamation, copyright infringement, computer hacking and theft of data, a variety of new consumer abuses may lurk on the horizon. These abuses include misrepresentation, deceptive advertising, fraud, service and pricing abuses, pyramid schemes, and the sale of second-rate or damaged merchandise.
>
> The problem is not so much that the Internet is unregulated, but that no entity is actually monitoring what is going on in Cyberspace.[89]

One recent (Fall of 1996) Internet-aided fraud used e-mail messages as the medium. The scam was designed to produce international phone calls to the British Virgin Islands, generating income for the phone company there. The scam operator sent e-mail messages with a faked return address, threatening some unexplained legal action in the event of failure to respond promptly, and gave a phone number in the 809 area code to call to discuss the matter. The caller is billed $3 to $5 for the call (possibly much more), kept on the phone listening to a taped message, and sometimes eventually told that it must be a trick played by the caller's friends and to pass it along to someone else, chain letter fashion.[90] It is not clear what sort of protection there is against this sort of fraud except for a well-developed incredulity on the part of Internet users.

Another type of scam has involved stock sales. According to a report in the *San Francisco Examiner*, "Securities regulators are investigating several cases in which brokers or corporate insiders may have used the Internet last month [May 1996] to

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[89] CyberCop Precinct House, http://www.ucan.org/holdcell.htm. The organization's Web site states, "CyberCop is NOT a public law enforcement agency. In fact, ICAN [its sponsor] does not receive any tax dollars. It is a project of UCAN, a nonprofit membership consumer group based in San Diego, California."

[90] Summarized from Ramon G. McLeod, "Internet Scam Has you Dialing the Caribbean," *San Francisco Chronicle*, October 3, 1996, p. A2.

anonymously tout stock that they were trying to dump . . . ."[91] The Securities and Exchange Commission has published a brochure alerting investors to fraud on the Internet and advising on ways to avoid it. SEC cautions include:[92]

- Be wary of promises of quick profits, offers to share "inside" information, and pressure to invest before you have an opportunity to investigate.

- Be careful of promoters who use "aliases." Pseudonyms are common on-line, and some salespeople will try to hide their true identity. Look for other promotions by the same person.

- Watch out for offshore scams and investment opportunities in other countries. When you send your money abroad, and something goes wrong, it's more difficult to find out what happened and to locate your money.

The SEC summarizes, "While investment con-artists have been quick to seize upon on-line computing as a new way to cheat investors, the types of investment fraud seen on-line mirror frauds perpetrated over the phone or through the mail. Consider all offers with skepticism."[93]

The speed with which messages may move and multiply on the Internet appears to spread investment fraud more quickly than might be expected through print and telemarketing means, but does not change the basic methods.

Standard warnings to users of the Internet include:

- Don't reveal passwords.

- Be cautious with credit card information or other confidential or sensitive information.

- Purchase only from organizations known to be reliable--know who you are dealing with.

- Report suspicious activity.

These are the same kinds of cautions that consumers should observe when solicited on the telephone or doing business in the local mall, not just on the Internet.

Aggressive con artists online besiege users of America Online and other services with artfully phrased requests for passwords and credit card information, claiming that they

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[91] Neil Roland, "Regulators probe possible Internet Investment Fraud," *San Francisco Examiner*, June 14, 1996, p. B1.
[92] Selected from list in "Be Alert For Telltale Signs of On-Line Investment Fraud," posted at http://www.sec.gov.
[93] "Investment Fraud and Abuse Travel to Cyberspace," posted at http://www.sec.gov.

represent the service provider and need the information for validation purposes or to correct some problem with the system.[94] New users (called "newbies") sometimes fall for these frauds and then find that their accounts have been hijacked.

Even large, legitimate, established companies have been found by consumer protection organizations to have engaged in improper or misleading solicitations for online services. CyberCop, for example, has cited America Online and CompuServe for their "free trial" promotions, which require use of a credit card in order to take advantage of the offer and may make cancellation of the service at the end of the free trial period difficult.

The Council of Better Business Bureaus has announced plans for an online service, endorsed by the Federal Trade Commission, to certify businesses online and to combat online fraud and deception. According to a *Web Week* report on the proposal:

> A group of founding sponsor companies, including Hewlett-Packard Co., AT&T, Ameritech, Eastman Kodak Co. and Netscape Communications Corp., have invested a total of about $2 million to launch the service . . . . In banding together, the group also is sending a signal to federal regulators that self-regulation, rather than restrictive government mandates, can keep the Internet safe for electronic commerce.[95]

Signal or no signal, fraud is fraud, and it seems unlikely that state or federal law enforcement and regulatory agencies will feel comfortable in leaving prevention and enforcement entirely to private initiative, or believe that it is appropriate to do so. Further, private agencies do not have the criminal sanctions that are available to law enforcement agencies.

The key need with respect to law enforcement agencies attempting to cope with Internet-based fraud is *multi-jurisdictional cooperation*. Senior Assistant Attorney General Herschel Elkins is head of the Consumer Law Section of the California Department of Justice, and in that capacity handles fraud complaints. He describes Internet frauds as being the same types as are perpetrated by other means: investment scams, get-rich-quick schemes, advance fee loans, and gambling. Difficulty in determining exactly where a particular scheme originates leads to the need for state attorneys general, the U.S. Department of Justice, Federal Communications Commission, and Federal Trade Commission to cooperate, sometimes along with authorities from other nations.

The National Association of Attorneys General has set up a committee to deal with Internet-related issues. That committee has not yet issued a report. In the meantime, Mr. Elkins feels that "the State of California is doing about all it can now," although the arrival of digital cash will increase the risk of online fraud. In summary, he added, specific cases

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[94] I can attest to this from long personal experience. It is an almost constant annoyance on America Online.

[95] Susan Moran, "Better Business Bureau Targets Electronic Fraud," *Web Week*, August 5, 1996, posted at http://www.webweek.com.

require communication among agencies to determine who has jurisdiction and who should file lawsuits or criminal charges.[96]

California state law (*Business and Professions Code*, §17358) provides certain protections for purchasers of goods and services through telephone and mail order. These protections include prompt delivery of merchandise, provisions for notification of delays and refund if preferred by the customer, and various notices to purchasers. Assembly Bill 3320 (Speier, enacted as Chapter 785, Statutes of 1996) extended those protections to purchases made via the Internet. Although these protections cannot eliminate fraud, they do establish standards, define them in the context of the Internet, and make them consistent across the competing sales media.

Trademark and Domain Name Disputes

In brief, "Trademarks [and service marks] are words, symbols, or other devices used to distinguish the goods or services of one person from those of another."[97] Trademarks and service marks may be words and phrases, graphic designs, letters and numerals, abbreviations and nicknames, and even colors under some circumstances.[98] Internet domain names may now qualify as trademarks, although this is an area that is unsettled at this time, as "a number of problems arise if traditional trademark law is applied to domain names."[99] The term "service mark" applies to a term or symbol that identifies a *service* rather than tangible *goods*.[100] In the rest of this section, the term "trademark" encompasses both service marks and trademarks.

Unlike copyright (a federal responsibility under the U.S. Constitution, Article I, Section 8), trademark falls under state and federal jurisdiction. California's law regarding trademarks is §§14200-14214 of the *Business and Professions Code*. A trademark may be registered with the state if it meets the applicable requirements. "Registration of a mark with the Secretary of State under this chapter," which is effective for 10 years and may be renewed, constitutes "constructive notice of the registrant's claim of ownership" of the trademark.[101]

The rise of the Internet is affecting the registration, use, and protection of trademarks. The instant worldwide availability of information on the Web places trademarks before national and global audiences, where previously they might be seen only in a relatively small geographic area. Acme Widgets Company's "AcmeWidget" brand, registered in California as a trademark, might now appear around the world at "www.AcmeWidget.-

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[96] Herschel Elkins, personal communication, October 31, 1996.
[97] Thomas J. Smedinghoff, ed., *Online Law* (Reading, Massachusetts: Addison-Wesley, 1996), p. 209.
[98] List adapted from *ibid.*, pp. 209-10.
[99] Jonathon Agmon, Stacey Halpern, and David Pauker, "What's in a Name" (section: "The Relationship Between Domain Names And Trademarks"), posted at http://www.law.georgetown.edu/lc/internic/-domain1.html.
[100] See *California Business and Professions Code*, §§14206 and 14207.
[101] *Business and Professions Code*, §§14242 and 14250.

com." That is, unless some other company has already claimed that domain name or otherwise posted an "AcmeWidget" mark online, in which case multi-jurisdictional litigation may be required to settle the question of who is entitled to use the mark.[102]

Trade *names* pose similar, but not identical issues. The trade name applies to the business, while the trademark applies to the specific product (or if a service mark, to the specific service). It is not uncommon for many businesses to use similar trade names because they are serving different areas or are in different lines of business. There may be a Domino Pizza, a Domino Sugar, and a Domino Software, as the products and services are so different as to have no significant potential for confusion among the public. There may be a Papa John's Pizza in Dubuque, another in Sacramento, and another in Chicago, each duly registered in the respective state. But there can be only one www.papajohnpizza.com on the Worldwide Web--and for that matter, only one www.papajohn.com. In these examples, "papajohnpizza" and "papajohn" are *second-level domain names*, in contrast to com, net, edu, mil, and gov, which are top level domain names. Conflicts arise over second-level domain names. Second-level domain names are currently assigned by designated registries, including InterNIC (see Chapter 1, above), under the general oversight of Network Solutions, Inc., which in turn exercises authority granted by the National Science Foundation.[103]

Disputes over second-level domain names include hijacking, reverse hijacking, and legitimate competing claims. In the case of hijacking, someone has acquired a second-level domain name in order to keep someone else from using it or to demand payment for relinquishing it. Reverse hijacking involves a trademark holder's seeking to take a second-level domain name away from someone else who as a legitimate claim to use it. Legitimate competing claims involve disputes among companies that each have a valid claim on the name (for example, Acme Widgets, Acme Construction, and Acme Foods all claiming www.acme.com).[104]

The likelihood of dozens of new top-level domain names, administered by dozens of new organizations, promises to complicate and multiply domain name disputes.

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[102] Senate Bill 1034, Calderon (1995-96 session), would have prohibited "the unauthorized registration or use of another's registered trademark as a domain name . . . ." The bill passed the Senate 38-0, but was not voted on by the Assembly.

[103] For more information, see, for example, "Domain Name Registration: Frequently Asked Questions," posted at http://rs.internic.net/domain-info/registration-FAQ.html. Note that FAQ is the commonly used acronym for "frequently asked questions," basic question-and-answer documents on countless topics on the Internet.

[104] This list is loosely adapted from Jamie Murphy and Brian L. Massey, "Battles over Web Addresses Grow As the Internet Explodes," *New York Times* (on line), September 11, 1996. Murphy and Massey cite Smedinghoff, who is with the law firm of McBride Baker & Coles, as their source. Agmon, Halpern, and Pauker, cited above, provide information on many domain name disputes.

Antitrust and the Internet

Although the Internet itself is a decentralized phenomenon not subject to monopoly control, the role of a handful of companies producing Web browsers to access the Internet has raised antitrust issues. Netscape Communications' "Netscape Navigator" software quickly dominated the browser market until the entry of Microsoft Corporation, with its Microsoft Internet Explorer. Because of Microsoft's dominance of the PC operating system market (DOS, Windows, Windows 95, Windows NT) and its huge presence in the market for programming languages and tools, office applications, and home and personal software, it has been a target of concern over possible unfair competition.[105]

When Microsoft released Windows 95, it included its browser software and access to the Microsoft Network, a move that was immediately viewed as anticompetitive. Reaction to that bundling of access with the operating system (and the fact that Windows 95 disabled other Internet access products) forced a retreat, but the company has moved forward with new releases and free distribution of the browser, cutting into Netscape's share of the personal-use market. In August 1996 Netscape Communications filed a request with the Justice Department to investigate possible anticompetitive practices by Microsoft in connection with its Worldwide Web-related activities, questioning whether the company had violated an existing antitrust agreement. Netscape charged Microsoft with "a wide variety of predatory pricing and bundling behavior that violates the antitrust laws."[106]

It seems likely that the U.S. Department of Justice will be sensitive to potentially anti-competitive activities and that Microsoft's competitors will continue to seek federal intervention if they deem that necessary. Competitors are also forming alliances to counterbalance Microsoft's influence.

Telecommunications Regulation

Telephone companies and services are regulated by the states and by the federal government. Interstate aspects are under the jurisdiction of the Federal Communications Commission (FCC), and within California regulation is the responsibility of the Public Utilities Commission (PUC).[107]

In brief, "The [California Public Utilities] Commission has dual jurisdiction with the Federal Communications Commission ('FCC') over California LECs [local exchange carriers--local phone companies].. The CPUC has jurisdiction over *intra*state matters and

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[105] For a readable, if opinionated, review of assertions about Microsoft, see James Gleick, "Making Microsoft Safe for Capitalism," *New York Times Magazine*, November 5, 1995, and posted at http://www.around.com/microsoft.html (this is on Gleick's Web site).

[106] Netscape's long and detailed letter detailing its claims against Microsoft has been posted on line, including at http://radon.gas.uug.arizona.edu/~bernster/netletter.html.

[107] For an overview, see California Public Utilities Commission, Commission Advisory and Compliance Division, Telecommunications Branch, "Telecommunications Regulation in California: A Primer," May 1995.

the FCC handles *inter*state matters. The FCC's jurisdiction applies to the extent that LECs provide access to interstate services. Both jurisdictions impose requirements with which the LECs must comply."[108] Federal telecommunications law was overhauled by the Telecommunications Act of 1996, many provisions of which are yet to be filled out in regulation, are under litigation, or both.

Local exchange carriers in California range from giant Pacific Bell, with over 15 million lines, to Pinnacles, with about 200. Pacific Bell and GTE California (about 3.9 million lines after merger with Contel) account for nearly 99 percent of all telephone access lines in California.[109]

Neither the FCC nor the California PUC regulates Internet access services as such. The PUC has no plans to do so, as "Internet access is completely competitive," according to one staff member. Another PUC staff member confirmed that ISPs simply provide a service over the phone lines, but are not an element of the regulated telecommunications industry. Regulation affects Pacific Bell and other telephone service providers (some of which have begun to provide Internet access services not subject to rate-setting by PUC), and there is no apparent statutory authority to regulate ISPs, nor any apparent potential benefit in doing so.[110]

There may, however, be reason for the PUC to evaluate the impact of Internet access services on local phone loops, to determine whether some regulatory response is required to congestion generated by lengthy Internet access calls. This issue is explored in the next section.

The Load on the Phone System

Recent press reports have cited telephone industry assertions that POTS is threatened by growing dial-up Internet access.[111] The problem is that calls to Internet service providers are much longer than typical phone calls, averaging nearly 21 minutes, compared to under 4 minutes. Some Internet calls last for hours, and some for days.[112] Once the call reaches

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[108] *Ibid.*, p. 2.

[109] Condensed from *ibid.*, p. 1.

[110] Personal communication, October 29, 1996, with PUC staff members who wished not to be quoted directly. The Public Utilities Commission has adopted standards for "universal access" to telecommunications services, although the PUC's definition of that term does not yet include Internet access. The Federal Communications commission on November 8, 1996, issued a massive "recommended decision" regarding universal access that touches on Internet access, but that decision came too late for review for this paper. A follow-up paper by the California Research Bureau will examine state and federal universal service requirements and proposals and their relevance to Internet services.

[111] For example: "Soaring Internet usage threatens to create gridlock in American phone system, *Nando Times* (from Reuter Information Service), October 29, 1996; Simson Garfinkel (technology columnist), "PhoneCrash: Who will pay to prevent the Internet from killing the national phone system?", http://www.packet.com). Similar reports also appeared in the *Sacramento Bee, San Jose Mercury News*, and *Los Angeles Times*.

[112] Days-long dial-up Internet connections are probably very rare, as services typically disconnect the user after 15 minutes of idleness.

the ISP it is handed off to a data network and leaves the voice telephone system (although data may travel over lines owned or leased by long-distance phone carriers). It is the lengthy use of the local loop (local exchange phone line) en route to the ISP that is overloading switch capacity. That problem affects local phone services, not long-distance carriers.

According to one news report, "PacTel [Pacific Telephone] said a study of one Silicon Valley telephone switch showed 16 percent of call attempts failed during peak evening hours because of Internet traffic, and 2.5 percent of lines used by Internet service companies absorbed 20 to 36 percent of the switch's capacity."[113] Added capacity reduced the level of failed connect attempts to 1 percent, although some areas in Los Angeles are at risk of similar congestion.[114]

Long-distance telephone carriers, such as AT&T and Sprint, pay an access charge to local phone companies for calls from and to the local company (called a local exchange carrier, LEC).[115] Online service providers, however, are exempted from access charge provisions:

> Back in the early 1980s, just before online services started taking off, the FCC issued an order giving online firms a "temporary exemption" from telco access charges. The rationale was that access charges would have added significantly to the cost of online access--more than $2 an hour (access charges were higher then)--and could have kept the industry from getting off the ground.[116]

A 1987 FCC finding that the exemption was no longer necessary died under a hail of opposition from online service users. The telcos sought reopening of the case for online service access charges as a means of funding system improvements to handle the load generated by Internet dial-up access. In December 1996, the FCC explicitly declined to levy access charges on Internet service providers and other data networks, although it may revisit the issue in the future.

Complicating the question of access charges for Internet access is that the telcos themselves have entered the Internet access field. Pacific Telesis has an Internet subsidiary (Pacific Bell Internet Services), which offers dial-up access via numerous POPs in California. Pacific Bell has even offered 5 months of free, unlimited dial-up Internet access for subscribers buying a second home phone line (which will also be provided at a discounted

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[113] "Soaring Internet Usage."
[114] "Surging Internet Use Strains Phone System," *Los Angeles Times*, October 31, 1996, p. A1.
[115] "Access payments to LECs are approximately 45% of IXCs' cost of providing long distance services," according to Mark A. Jamison, Manager, Regulatory Policy and Coordination, Sprint Communications, in "A Competitive Framework for Pricing Interconnection in a Global Telecommunications Market," posted at http://www.sprint.com/analyst/paper, and originally published in the *Denver Journal of International Law and Policy*, Vol. 23 No. 3, Summer 1995, pp. 513-33.
[116] Garfinkel, "PhoneCrash."

rate).[117] This would seem to aggravate the problem of local loop congestion, especially as a second line would likely be used for longer Internet-access calls than would a home-owner's single line, which would also be needed for regular phone calls.[118]

AT&T is also an ISP (so is long-distance carrier MCI). The long-distance carriers pay access charges in connection with their phone services, but not their packet-switched data services. Technology columnist Simson Garfinkel quotes Mike Miller, speaking on behalf of AT&T, as saying:

> We believe that the access charges that the local exchange companies are charging are really exorbitant. They are way above cost and need to be brought down. We think that when the local exchanges bring down the access charges to a more reasonable level, something approaching costs, then that is the time to look at bringing the access fees for the data circuits into line with the other charges.[119]

Small ISPs are nervous about proposals for fees on their operations to fund telco expansion and upgrading to cope with the dial-up Internet access load, viewing the proposals as anticompetitive.[120]

There may be alternative solutions. Details are beyond the scope of this paper, but one is worth mentioning:

> . . . perhaps the most interesting suggestion is to have phone companies reprogram their switches to recognize the phone numbers of popular online service providers in each metropolitan area. Instead of sending the calls through to the provider's central office, the phone company would send them to a special modem bank that the telco would operate at each exchange. The phone company could then run the data over its own packet-switched data network to the particular online service provider for which the phone call was originally destined. Consumers would never see a difference.[121]

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[117] This offer was made via a flyer sent to Pacific Bell customers. A single month of free unlimited access is advertised at the Pacific Bell Web site, http://www.kn.pacbell.com. The notice there describes a $20 per month flat-rate dial-up service available "in over 350 communities in four key regions of the state--Sacramento, San Francisco, Los Angeles and San Diego." Access for Fresno, Stockton, and other metropolitan areas in the state is to be added by 1997, according to the notice. Pacific Bell also offers a less-expensive option with limited hours per month. (Strictly speaking, Pacific Bell Internet Services is a wholly-owned subsidiary of Pacific Bell, not a division or department.)

[118] Pacific Bell, Pacific Bell Internet, and Bellcore did not respond to inquiries on this issue.

[119] Garfinkel, "Phone Crash."

[120] This opinion was offered by the president of a Sacramento-area ISP.

[121] Garfinkel, "Phone Crash."

Although this is feasible now, according to Simson Garfinkel, it would still involve costs that phone companies are unlikely to want to absorb.[122]

It does seem clear that the question of Internet's impact on local phone services will have to be addressed somehow. Some estimates suggest that 8 percent of California households currently have Internet access. If that percentage doubles over the coming year, and doubles again over the next year, it will reach nearly a third of households, and the impact on the telcos will grow accordingly.

As if this were not already complicated enough, long-distance carriers, too, face Internet-related issues. It is now possible to conduct telephone conversations via the Internet without incurring long-distance charges.[123] Voice signals are converted by hardware and software into digital signals, conveyed to and across the Internet in the same manner as text and other types of data files, and reconverted into voice at the receiving end. The only requirement is that sender and receiver have compatible systems. If they do, they can carry on conversations, possibly with somewhat reduced sound quality, just as if they were local calls or as if they were text messages exchanged across the system. Internet telephony can span not only the nation, but the world. Internet telephony hardware and software vendors are competing actively in this market, although there is not yet a single standard for the service.

If Internet access continues to spread and if use of Internet telephony becomes common, the impact on long-distance carriers could be profound, and that impact could in turn affect local telephone companies that would lose access fees from long-distance telephone carriers.

Online Commerce at Risk from Power Failures

In addition to the threat posed by congestion on the Internet, recent widespread power outages in the West underline the risks of growing dependence on a medium that is crippled when the power is out. A power failure in one part of the country can now affect communications and commercial activity in the entire country and around the world. Bear in mind that the telephone system usually continues to function during power outages, as

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[122] Whether they could absorb them is another question. Pacific Telesis Group's sales for 1995 totaled $9.042 billion, with net income of $1.048 billion. Data at http://www.hoovers.com.

[123] This development has been widely covered in the press. See for example: "Internet users discover toll-free long distance calls," *Nando Times* (carrying a Scripps-McClatchy Western report), http://www.-nando.net/newsroom/ntn/info/110696/info6_12940.html; Gus Venditto, "Internet Phones--The Future is Calling," *Internet World*, June 1996; "Wrestling over the Future," *U.S. News and World Report*, April 15, 1996 (as posted at http://www.usnews.com). The issue of Internet telephony is also before the FCC, raised by a petition from the America's Carriers Telecommunications Association. A response that petition, posted by a group of Internet telephony providers, is posted at the Voice on the Net (VON) Coalition site, http://www.von.org/reply.html. Long-distance carrier (and "world's largest carrier of Internet traffic") Sprint is a member of the VON Coalition, according to a June 19, 1996 VON press release.

copper phone lines also carry the power needed to make phones usable.[124] If network connections fail or if servers are down on account of power failure, however, the fact that consumers' telephone connections still work will still not get around that failure.

Boardwatch's Jack Rickard, in his review of Internet architecture, suggested that "there is a fear that somewhere in the Internet there is a single router that all of this hangs on such that one power hiccup and the entire network takes a tumble."[125] Among the possible consequences of a power failure in a network-dependent commercial world are:

- Business Web sites could become unavailable, leading to deferred or lost sales.
- Individual users, possibly over a wide area, might be unable to access *any* online services, whether information, financial, commercial, or other.
- Corporate users could lose access to e-mail and electronic data interchange across the Internet, interfering with operations.
- Government information sites on the Internet could become inaccessible, with potential result of swamped telephone lines to offices, inaccessibility of services, or both.

The scope of such problems is a factor of the scope and location of any power failure. In an internetworked world, however, a service interruption in, say, San Francisco, could affect users around the world no matter how well their power supply is holding up.

As if to illustrate, the day after the discussion above was written there was such a failure at the campus of Stanford University, possibly the result of rats in a generator ("Workers found two rats, crisp and dead," according to one report). The power failure cut off lines to BBN Corporation, a major Internet access provider. Among the sites affected were those of the *Los Angeles Times*, various technology companies, the University of California at Berkeley, and Stanford University.[126] This is one example of a local power failure affecting worldwide access to prominent Web sites.

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[124] This does raise the technical issue, beyond the scope of this paper, that slow, copper "twisted pair" phone wiring carries power, while fiberoptic cables do not unless equipped with supplementary wiring to conduct power. This is a point that must be considered during any conversion of last mile systems to fiberoptic.

[125] Rickard, "Internet Architecture" (online version, as printed), pp. 8-9.

[126] Dan Reed, Mike Langberg, and Jennifer Mena, "Stanford blackout shuts off Net Access," *San Jose Mercury News* (online edition), October 12, 1996, and "West Coast Sites Darkened by BBN Power Outage" (Reuters), *New York Times* (online edition), October 12, 1996. The "crispy rats" quote is from the *Mercury News* article.

Policy Options

- **Fraud prevention and prosecution.** Although the Internet does not create new types of fraud, it does create a new avenue for existing types of fraud, such as investment scams, pyramid schemes, overbilling, and failure to deliver merchandise. The Legislature could undertake to assure that state and local law-enforcement personnel are as well trained in the detection, prevention, and prosecution of fraud on the Internet as they are in combating fraud by other means, including understanding of the role of interjurisdictional cooperation in addressing crime on the Internet.

- **Sales tax on interstate transactions.** Although the Internet does not itself change the issues of sales and use taxes on merchandise sold to residents of California by companies in other states, its use as a sales medium could lead to significant increases in interstate sales and thus to larger losses of revenue. If so, California might choose to seek modification of the Supreme Court's Quill decision through new litigation focusing on the new questions raised by Internet-based commerce or through pursuit of federal legislation addressing sales tax liability for interstate sales.

- **Digital signatures.** It may be appropriate to extend California's digital signature law to establish standards for general commercial use of digital signatures, in the light of comparable legislation adopted by Utah and other states.

- **Online payment.** As commerce on the Internet grows, it may become increasingly necessary and appropriate for California state agencies to make purchases of goods and services online. In preparation for online purchasing, the Legislature could consider directing the Department of Information Technology to evaluate and report to the Legislature on payment options that may be used by state employees and agencies who must pay for goods and services online, with emphasis on security of those transactions and prevention of fraud and abuse. Evaluation of online payment systems and options could consider Internet-based options in the context of *all* types of electronic commerce, not exclusively those that use the Internet.

- **Internet access impact on local phone service.** Local phone companies have asserted that Internet access calls are overloading local loops and requiring costly equipment upgrades. Internet service providers dispute the severity of this impact. To clarify the matter, the Legislature could direct the Public Utilities Commission to examine the impact of Internet access on local telephone exchange carriers, to determine how any additional costs resulting from Internet access could be allocated among local exchange carriers, ISPs, data networks, and long distance carriers. The examination could include public hearings.

- **Internet telephony.** One of the rapidly growing features on the Internet is the capacity to conduct voice phone calls through packet-switching technology, circumventing long-distance voice carriers. As this technology indirectly affects a regulated industry, the Legislature might choose to direct the Public Utilities

Commission to evaluate intrastate aspects of issues raised by Internet phone services in order to determine whether competition with long distance carriers requires regulatory response.

- **Interstate regulation consistency.** California is not alone in its concern for the potential use, abuse, and impacts of online commerce. To assure that the state is not placed at a disadvantage in this commerce, and to maximize the ability to prevent fraud, the state could seek consistent interstate business regulation through interstate agreement and necessary federal legislation.

- **E-mail return address.** A growing problem on the Internet is "spam," or mass commercial e-mailings, often with phony return addresses. To combat abuse of e-mail and to minimize the potential for fraud, the state could require all California-based senders of commercial e-mail to provide a valid and stable (that is, not closed soon after the mailing) e-mail return address in all such e-mail. This would be broadly comparable to the existing requirement in the *Public Utilities Code* that "a caller shall not be allowed to withhold the display [via caller ID] of the caller's business telephone number when that number is being used for telemarketing purposes" (§2893).

- **Taxation of Internet access services.** Internet access services are not currently subject to sales tax or an excise tax in California. Some other states do apply such taxes. California could consider whether the sales tax could be extended specifically to Internet access charges or whether to impose an excise tax on those services. If the state chooses to impose such tax(es), it could direct the proceeds to the General Fund or earmark them for specific purposes, such as support of information resources for underserved populations or state government use of the Internet as a medium for providing information and services to the public.

CHAPTER 3: GOVERNMENT ON THE INTERNET

What kinds of information do government agencies post for the public and what services do they provide online? This chapter gives an overview and selects some representative sites for purposes of illustration.[127] There are many to choose from, as numerous U.S. Government and State of California agencies are on the Internet, as are all other state governments and numerous cities, counties, and regional governments across the country. Web sites, including "State Search," from the National Association of State Information Resource Executives, organize links to state and local governments and facilitate access.[128]

There are pros and cons to government use of the Internet to provide information and services. On the "pro" side:

- Staff time may be saved and used more efficiently by putting frequently requested documents and forms online and by listing contact persons, office addresses, and phone numbers on Web sites.

- Costs of reproduction and mailing may be reduced through online documents and forms.

- By reducing the number of phone calls for such documents, agencies may better serve those who must call for information rather than find it online.

- Inquiries and comments may be posted via e-mail any time of day or night rather than having to wait for business hours.

On the "con" side:

- Most people do not yet have Internet access, especially those with low incomes and limited education.

- Downloaded documents and forms usually must be printed by the recipient, which may be inconvenient and expensive.

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[127] A more complete list of California and federal agencies on line was originally to have appeared in appendixes to this paper. It quickly became apparent that it was futile to attempt to list all such agencies, as so many *do* now have a Web site, gopher site, or other presence on the Internet. The quality and extent of the sites vary, but it can be expected that, as experience diffuses among agencies, standards will emerge and agency sites will become more comprehensive. Some Web pages featuring extensive collections of governmental links are described in the Appendix to this paper. Web users can easily reach any publicly accessible California State Government site on the Internet through those pages, including the official California Home Page, http://www.ca.gov.

[128] State Search is on the Web at http://www.state.ky.us/nasire/. Also see state and local links at http://www.piperinfo.com/piper/state/states.html.

- The Internet may be difficult to navigate and use.

- Congestion on the Internet may make it difficult for people to access sites, especially at busy times for particular sites.

It will take time and experience to determine whether the pros or cons predominate and to work out the most effective means of using the Internet to provide government information and services.

Federal Government

The U.S. Federal Government has a large and growing presence on the Internet. "FedWorld" offers one way to find federal sites. Others include the Villanova Center for Information Law and Policy's "Federal Web Locatorand the Louisiana State University Library's "U.S. Federal Government Agencies Page."[129] A few examples below illustrate the scope of the federal government's Web sites. These examples are merely representative. LSU's listing of federal sites fills nearly a dozen single-spaced pages.[130]

Department of Agriculture

Among other information, the U.S. Department of Agriculture site (http://www.usda/gov) provides:

- USDA's News Releases

- Speeches

- Publications

- Agency Latest Reports

- 1996 Farm Bill

- Calendar of Agricultural Events and Speaking Engagements

- Public Affairs contacts and Freedom of Information Act Officers

Many reports (for example, Monthly Feed Outlook, Oil Crops Outlook, and Rice Outlook), previously provided on paper for a fee are now available only electronically and at no charge. Summaries of other reports are available online, although printed copies of

[129] Fedworld: http://www.fedworld.com; Villanova: http://www.law.vill.edu/Fed-Agency/fedwebloc.html (the hyphen is part of the URL); Louisiana State University Library site, http://www.lib.lsu.edu/gov/-fedgov.html.
[130] http://www.lib.lsu.edu/gov/fedgov.html.

the full reports are for sale, but the reports are not posted online. The site includes numerous sets of statistics as well as crop weather (state by state, but not for all states) and much other agricultural information.

The site also provides information about USDA programs, regulations governing those programs, and a search function that enables users to find information on specific topics.

Department of Education

Many subdivisions of the Department of Education have Web pages. These include:

- Office of Postsecondary Education
- Office of Science Education and Technical Information
- Office of Science Education Programs
- Office of Science Education and Technical Information (OSETI)
- Computational Science Education Project
- Office of Education
- Special Projects, which includes Minority, Disabled, Education, Women and other Special Projects
- Directorate for Education and Human Resources (EHR)
- Division of Elementary, Secondary, and Informal Education (ESIE)
- Division of Graduate Education and Research Development
- Division of Undergraduate Education
- Engineering Education and Centers (EEC)

The main Web page for the department (http://www.ed.gov/) includes links to reports, announcements, and other publications, programs and services, department offices and employees, initiatives of the Secretary of Education, grants and contracts, educational resources, and other (external) education-related sites. Archives of announcements are available back to 1994. A search facility is available for finding information on specific topics. Documents posted at the site include *A Teacher's Guide to the U.S. Department of Education*, *A Researcher's Guide to the U.S. Department of Education*, and *The Student Guide [to] Financial Aid from the U.S. Department of Education*.

Department of the Treasury

Treasury Department offices encompassed at the Department's site (http://www.ustreas.-gov) include:

- Internal Revenue Service
- United States Customs Service
- Bureau of Alcohol, Tobacco, and Firearms
- Financial Management Service
- United States Secret Service
- Office of Thrift Supervision
- United States Mint
- Office of the Comptroller of the Currency
- Federal Law Enforcement Training Center
- Bureau of Public Debt
- Bureau of Engraving and Printing
- Financial Crimes Enforcement Network

The site offers an online tour of the Treasury Building, a historic exhibit (the War and Savings Bond Exhibition), a brochure about the department, and of course links to the individual services and agencies within the Department. The one that may be of widest interest is the Internal Revenue Service (IRS), which posts forms, instructions, and other tax information online. Treasury, too, offers a search function.

U.S. Congress ("Thomas")

"Thomas," named for President Thomas Jefferson, is the U.S. Congress's Internet-based information service, provided through the Library of Congress. The site's uniform resource locator (URL) is http://thomas.loc.gov, where "loc" stands for Library of Congress.)

The main menu choices at Thomas are:

- About THOMAS

- Congress This Week
- Bills
- Laws
- Congressional Record
- Committee Information
- Historical Documents
- The Legislative Process
- U.S. Government Internet Resources

The site offers a search mechanism for finding legislation by bill number, author, and topic, gives access to reports, and explains the federal legislative process. It also provides links to many other sources of federal government information in executive, legislative, and judicial branches, plus state and local government links. In short, the site is virtual one-stop shopping for government information, with the exception that the list of local government links that may be reached by way of the site appears to be very incomplete.

State of California

Many departments and agencies in California State Government now have Web sites or other presence on the Internet. The California Home Page (http://www.ca.gov) offers one starting point for finding State agencies online. This section describes a few of the California state department and agency sites that may be reached by way of the California Home Page.

Department and agency sites vary widely in design and content. In general, they provide routine information such as office addresses and phone numbers, program descriptions and explanations, brochures and reports, forms, and links to related sites. California state sites are sometimes slow to respond, at least during business hours.

Alcoholic Beverage Control Department

ABC's site, http://www.abc.ca.gov/, offers information on the history and mission of the department, its executives and organization, office locations, press releases, program descriptions, California law regarding alcoholic beverages, and answers to "frequently asked questions" (FAQs). The FAQ list is extensive, and appears likely to be responsive to many routine types of inquiry from vendors of alcoholic beverages and from the general public. The answers are tedious to retrieve, as each one is a separate file.

Attorney General (Department of Justice)

The Department of Justice Web site, http://www.ns.net/caag/, provides a wide range of statistics, publications, program descriptions, and crime and law-enforcement resource links. Among the latter are the California Criminalistics Institute and "Virtual Libraries" in criminalistics and criminal justice as well as a wide range of other agencies, organizations, and resources. One link, the Police Officer's Internet Directory,[131] is a comprehensive source of information and of links to agencies, including local police departments. In short, the DOJ site is not only a starting point for California Department of Justice information, but also for crime and criminal justice information in general.

According to Greg Wells, of the Public Inquiry Unit, the Web site has been a useful and efficient way to respond to public requests and to reduce the number of routine phone calls. He termed the site "quite a benefit," in that by redirecting some routine calls to the online service, it has enabled faster response to persons who do phone for assistance or who may not have access to the Internet. The site also illustrates the way in which hyper-linking may be used to ease access to online resources literally of worldwide scope.

Chapter 258, Statutes of 1996 (Senate Bill 1519, Johnson), requires the Department of Justice to establish a publicly accessible online directory regarding: persons who are the subject of an arrest warrant for a violent felony; missing children; and unsolved homicides. The bill has not yet been implemented (as of December 1996), and no specific funding was provided for implementing the bill. The missing children portion is to be addressed first, with the rest completed later, as soon as priorities and resources permit.[132]

Department of Boating and Waterways

The Boating and Waterways site, http://www.ceres.ca.gov/boating/, offers information on the department, its programs, and pertinent laws (the Harbors and Navigation Code). Few department publications are posted for downloading (as of November 1996, at least), but many are listed with information about how to obtain copies.

The site also provides links to other boating-related sites on the Internet, including the California Harbormaster Home Page, the U.S. Coast Guard, and the Scripps Institution of Oceanography.

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[131] This site is a remarkable compilation, described as: "created and maintained by James Meredith, a Boston Police Officer. This Directory is personal property, and is in no way associated with, or endorsed by, the Boston Police Department."

[132] Status information was provided by Doug Smith, Department of Justice, personal communication, December 30, 1996.

Department of Motor Vehicles

The DMV site (http://www.dmv.ca.gov) includes:

- Forms
- Handbooks
- Office Locations
- Informational Brochures
- News Releases
- Business Licensing
- California Codes
- DMV Profile
- Environmental License Plates

Some forms, documents, and information are available in Spanish as well as English.

Department of Parks and Recreation

The Parks and Recreation site (http://www.ceres.ca.gov/parks/dpr.html) offers extensive information on California's state park system, an A-to-Z list of the parks, phone numbers, answers to "frequently asked questions," event information, and links to related sites, including the State Parks Store, the California Department of Tourism, and CERES (California Environmental Resources Evaluation System). The site also offers a link to historical and archeological information on California, posted at an Indiana University Web site.

California State Legislature

Extensive information on legislation and the Legislature is available from several sites.

- The *State Senate* (http://www.senate.ca.gov) offers: legislative news; information on Senate leadership and links to Senators' home pages; bill text, status, history, and so on; information on Senate committees and offices; legislative schedules; information on how to participate in the lawmaking process; ballot measures; and other information and links.

- The *Assembly* site (http://www.assembly.ca.gov) offers a legislative search function, the ability to "watch" up to 300 bills, district and member information, links to the Democratic and Republican Caucuses, the Chief Clerk's office, Capitol Museum, and other features.

- The *Legislative Analyst's Office* (http://www.lao.ca.gov) offers legislative information, reports, and links to other legislative and governmental sites.

- The *Legislative Counsel's Office* (http://www.leginfo.ca.gov/) also offers access to legislation (current and prior session), a guide to accessing legislative information on the Internet, links to other governmental sites, and other information.

Local Governments in California

Many counties and cities in California have Web sites. Services, information, and functions offered by these sites vary widely, as do their layouts and appearances. For example:

- The *City of Los Angeles* Web site (http://www.ci.la.ca.us/) is a complex collection of governmental, cultural, historical, and other information, even including a photo archive. A "site map" facilitates navigation. The site allows comments to be sent to the overall site Webmaster or to any of 17 city departments and bureaus. The site has a link to the Mayor's Web page and links to individual City Council members' pages. It also provides links to related organizations, agencies, and institutions. The site received 882,312 visits (hits) from May through October, 1996, an increase of 70 percent over the previous six months.

- The *City of Oakland* has a comparably complex site (http://199.35.5.18/Oakweb/-index.htm), but one with a very different layout from the Los Angeles site. The site provides information on government (including links to some departments and council members), education, arts and leisure, and public services.

- The *City of Sacramento* (http://www.sacto.org/) provides information on and links to departments and services and elected and appointed officials. It also lists neighborhood associations, with contacts, phone numbers, and other information, and provides detailed city budget information. The site includes an A-to-Z list of public services, with office addresses and phone numbers.

- The *Lassen County* home page (http://www.snowcrest.net/scwa/lassen/lapage.htm) provides a County Map, Things to See & Do, Where to Stay, Calendar of Events, How to Get There, and Travel Information Services. Although the site is listed among county sites listed by the California State Association of Counties,[133] it is not run by the county government and does not provide information on the Lassen County Government.

[133] http://205.187.239.2/.

- The *San Bernardino County* site (http://www.co.san-bernardino.ca.us/) provides governmental, statistical, historical, cultural, and other information on the county. It includes information on cities within the county and links to those with Web sites. It also includes links to unofficial (not government-sponsored) sites, such as the Redlands Business Directory and the San Bernardino-Inland Empire Area Chamber of Commerce.

- Although it is not itself a local government site, *LUPIN, the California Land Use Planning Information Network* (http://www.ceres.ca.gov/planning/) gives access to important local government information. LUPIN is part of CERES, the California Environmental Resources Evaluation System. The LUPIN homepage has the stated goal "to formulate and implement an information service to support and address land use and planning via the CERES Web." In short, LUPIN is an Internet-based focus for California land use planning information, bringing together information that otherwise would be difficult and costly to find. The site offers a shortcut to a large and growing array of general plans, environmental documents, maps, and other information.

Policy Options

- **State Web page design.** As state agencies increasingly establish a presence online, the Legislature could request that all agencies follow current best practices for design of Web sites, for ease of use by the public, for ease and economy of maintenance, and to facilitate interactivity, so that Web sites may become "two-way streets" for the public to communicate with government agencies.

- **Responsibility for content.** As state information is increasingly placed online, agencies must rely on technical experts to set up and maintain Web sites and other publicly accessible Internet sites. The state could adopt as policy that selection of the content of these sites is to be determined by appropriate management and policy-setting personnel, rather than left by default to technical personnel.

- **Impact on state staffing needs.** The Internet requires new knowledge and skills in the state government workforce, both to create useful state Web sites and to use information resources on the Net. The Legislature could direct the Department of Personnel Administration (DPA) and State Personnel Board (SPB) to evaluate how use of the Internet to provide information and services is affecting state personnel classifications and staffing requirements, both in information-technology areas and in management and policy areas. DPA and SPB could establish appropriate new or revised classifications and any needed standards for training in view of the changing environment and needs. This evaluation could also consider where resources might best be redirected, increased, or decreased in the light of use of the new technology. Finally, given the widespread use of information technology skills, it may be appropriate to provide for placement of persons in information technology

classifications in units where the skills are immediately needed, rather than only in centralized, separate data processing units.

- **Security.** Recognizing the balance between *benefits* of the Internet as a resource for public information delivery and *risks* of online vandalism, and considering published reports of damage done to public agency Web sites by malicious intruders, California agencies need to be concerned about similar risks. The Legislature or one of its houses could hire or contract with a computer security consultant to advise it on the security of state Internet servers and Web sites and to propose any necessary strategies for minimizing security problems in the light of benefits of placing information on the Internet for wide public access.

- **Intranets.** Growth in the use of intranets (networks that use Internet-style software and techniques) in the private sector suggests that similar technology could also be productive for state agencies. The Legislature could consider directing agencies to adopt current standard network technology and methods wherever they would contribute to efficiency and effectiveness, and might consider authorizing one or more demonstration projects within state government specifically to test intranet technology for state agencies.

- **Cross-agency coordination.** Many issues cross agency and department boundaries. A Web site is a relatively simple and easily managed means of bringing together information from different agencies. State policy and practice could encourage departments with related responsibilities to cooperate in the development of Web sites to present a comprehensive view of and facilitate public access to the issues and programs with which they are concerned.

- **State-local links.** One of the greatest strengths of the Worldwide web is its ability to "hyperlink" sites, easing users' access to related sources of information. Because many state government issues and programs have relationships with local government issues and programs, state policy and practice could encourage agency Web sites to link to appropriate county, city, and regional organization Web sites and other public Internet resources.

- **"One-stop" service centers.** As Web sites may help to coordinate the distribution of information to the public, they may also serve to facilitate submission of information and applications from the public to multiple agencies. State policy and practice could encourage, where feasible, the development and use of "one-stop" online service centers to simplify submitting reports, applications, and other information and forms to multiple agencies and finding necessary or useful information spread among different agencies, departments, programs, and offices. This would be broadly comparable to California's network of Small Business Development Centers (SBDCs), which "provide one-stop access to free business counseling, planning, marketing and training programs."

CHAPTER 4: LIBRARIES AND EDUCATION ON THE INTERNET

> "A change is upon us--nothing could be clearer. The printed word is part of a vestigial order that we are moving away from--by choice and by societal compulsion . . . This shift is happening throughout our culture, away from the habits and patterns of the printed page and toward a new world distinguished by its reliance on electronic communications." (Sven Birkerts, *The Gutenberg Elegies*, 1994)

> "Exactly which problem will Web-surfing attack? Our children's insufficient shallowness? Excessive attention spans? Unhealthy fixation on in-depth analysis? Stubborn unwillingness to push on to the next topic until they mastered the last? We need less surfing in the schools, not more. The Web is a great source of pictures--are we trying to cure our children of excessive interest in the written word? Depraved indifference to glitz and snazzy graphics?" (David Gelertner, computer scientist, 1996)

New Media, New Issues

The transition to digital media format is raising huge questions for anyone involved in the creation, dissemination, or archiving of information.[134] The Internet only adds to the urgency of the issues already raised by the growth of digital media such as CD-ROM. It is already problematic that documents can be stored, edited, copied, and altered in digital form and distributed on CD-ROM disks, floppy disks, and tapes, and transmitted via modem. Now, however, documents may be sent to countless sites around the world via the Internet. This is a two-way street, as documents may be distributed by this means *and* may also be found online and downloaded, vastly multiplying the resources available to libraries of all kinds and sizes. Now even a small elementary school may have access to resources competitive with those available to much larger schools--periodicals, reports, instructional resources, and reference materials--resources previously available only with much more difficulty or expense.

However, the ready availability of so much material online and by way of digital storage media (such as CD-ROM) is raising issues, especially with respect to copyright, authenticity of documents, future usability of the resources, and appropriate use.

Copyright

Kalakota and Whinston summarize the problem of copyright in this new era:

> It is clear that the speed of technological development has outpaced the legal system and that digital copyright issues need to be resolved with some

[134] On this topic generally, see John V. Pavlik, *New Media and the Information Superhighway* (Boston: Allyn and Bacon, 1996).

> urgency. As customers zip down the I-way, protecting intellectual property rights and collecting dues from the copyright users promise to be challenging issues.
>
> The scope and magnitude of the problem is clear. The degree of potential copyright infringement on-line vastly surpasses the damage that can be inflicted with a photocopy machine. Anyone with a computer can make and distribute countless copies of anything digital, be it a book, a TV or computer program, or a piece of music. Even worse, the digital version can be sent to friends or even a bulletin board system (BBS) for "downloading" by anyone with a modem.
>
> . . . . . .
>
> In sum, the emergence of the I-way is dramatically changing, and will continue to change how people and businesses deal in information and entertainment products and services; and how works are created, owned, distributed, reproduced, displayed, performed, licensed, managed, presented, organized, sold, accessed, used, and stored. This leads to a clarion call for changes in the law.[135]

This is an issue that is important to California for several reasons:

- California's public schools, libraries, and government agencies use copyrighted materials of many types. They have a stake in the availability and cost of such materials *and* in avoiding potentially costly copyright infringement.

- California is a significant producer of copyrighted works of all descriptions, software, motion pictures and television shows, books, artwork, and more. California has an economic interest in the viability of these endeavors, just as it does in the viability of other sectors of the economy.

- Tax revenues derived from commerce in copyrighted works could be lost as a result of piracy of such works.

- The University of California is a publisher of copyrighted works and derives revenue from that source.

Copyright is a matter of federal law and of international agreement, the details of which are beyond the scope of this paper.[136] The essential point here, though, is that California has a stake in this issue from both sides of the picture, as producer and as consumer of information.

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[135] Kalakota and Whinston, *Frontiers of Electronic Commerce*, p. 585.

[136] But for more information, see: Kalakota and Whinston, *Frontiers of Electronic Commerce*, pp. 585-594; Thomas J. Smedinghoff, ed., *Online Law* (Reading, Mass.: Addison-Wesley, 1996), Chapters 8-11.

Authentication of Electronic (Digital) Publications.

The apparent ease with which the contents of Web sites belonging to the Federal Bureau of Investigation and the Central Intelligence Agency have recently been altered by malicious hackers illustrates the new risks and temptations of the internetworked world.

The alteration of the FBI and CIA sites was so blatant and obvious (intentionally so, of course) that it could not be missed by anyone. But what if someone had instead chosen to make subtle changes in a policy document, for example? What if someone were to alter the text of articles, books, reports, or even legislative documents posted online? How much damage could be done by such means, both directly and indirectly? Trust in the good will of the users of Internet is, on the basis of experience so far, plainly not sufficient protection against such damage.

Although discussion of the technology is beyond the scope of this paper, there are methods of authenticating documents. For example,

> Mathematical algorithms can be used to create digital signatures that, in effect, place a "seal" on a digitally represented work. These algorithms can be implemented through software or hardware, or both. Digital signatures can play an important role in ensuring data integrity.[137]

To make digital signatures an effective tool, however, it would be necessary to have some agreed upon standard(s), for publishers to apply digital signatures to works that are to be authenticated (a process that could be automated), and for users of the works to have the software, hardware, or both, as appropriate, to authenticate the work in question. For further security, authenticated copies of works would be filed with an archiving agency, such as the Library of Congress or an industry clearinghouse.[138]

The Corporation for National Research Initiatives and the Library of Congress are experimenting with an Electronic Copyright Management System. The system, now in a "testbed" phase, is designed "to gain experience with the technology, identify issues, develop a prototype of appropriate standards, and serve as a working prototype if full development is pursued later."[139] The system "will allow users to electronically submit a copyright registration application and its associated object [to] the Copyright Office," substantially reducing the time now required by the manual, paper-based system.[140]

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[137] Kalakota and Whinston, *Frontiers of Electronic Commerce*, p. 591.
[138] *Ibid.*, p. 592.
[139] *Ibid.*
[140] CNRI, "Electronic Copyright Management System," http://www.cnri.reston.va.us/home/cstr/LoC.html.

The Downside of Electronic Publication

The arrival of digital media has not been welcomed unanimously as rare and refreshing fruit. One critic is Clifford Stoll, well-known computer security expert and author of *The Cuckoo's Egg*, a book about the tracking of malicious hackers through cyberspace. Stoll raised his reservations about the information highway in his book *Silicon Snake Oil*. He considers the institution most threatened by wide area networks (including the Internet) to be *libraries*:

> . . . the more information that's online, the less reason for the library. A fully online library needs neither books nor reference librarians; in their place are CD-ROMs and help files. It's a bookless library.[141]

This may be overstatement. Printed books have advantages and attractions that digital books do not. For example, you can put a book in your backpack and take it with you to the park or read it on the bus, and there is something very pleasant about opening a new book for the first time. Besides that, you can open a book and look at the pictures without having to wait for them to appear on a display screen, which can be a very long process on the Internet.

Nonetheless, there are some very real concerns as information moves toward digital form. Not the least of these is the long-term ability to use those digital files. Hardware and software standards change, and as they change they make old media (or at least old file formats) obsolete and sometimes unusable. A few years from now, today's reference books on CD-ROM may be difficult to use because some new type of device has taken the place of the CD-ROM drive. New standards for video and sound may likewise make old interactive software unusable, requiring the purchase of new versions of the software along with new computers. For comparison, think about the countless recordings on 78 and 33-1/3 RPM records that are now unusable for most people because record players are scarce and difficult to keep in working order.

Libraries and librarians will face the challenge not only of maintaining printed resources (books, magazines, newspapers, pamphlets) but also of taking care of--and maintaining *access to*--disks, tapes, CD-ROMs, and other media.

Appropriate Use

Public libraries that provide Internet access may be subject to special concerns in several areas:

- Is library equipment being used to access or distribute pornography or "indecent material"?

[141] Clifford Stoll, *Silicon Snake Oil: Second Thoughts on the Information Highway* (N.Y.: Doubleday [Anchor Books edition], 1996 [copyright 1995]), p. 174.

- Is library equipment being used to access or distribute hate-oriented sites (anti-Semitic, anti-Black, and so on)?

- Are library patrons abusing copyright restrictions by means of library-provided access?

- How should libraries view advertising online? Is it inappropriate on publicly funded terminals? Is it simply a necessary aspect of using a commercially supported medium that provides real benefits to users?[142] Is it no different than the advertising that is a normal part of magazines and newspapers found in libraries?

Public libraries serve a diverse clientele and one that is less appropriately limited in its Internet use than public school students in the classroom. It might be considered unacceptable to restrict adult library patrons from some materials that would be considered inappropriate for schoolchildren. Community standards, however, might well dictate some restrictions, especially on sexually explicit or graphic content. Administrators might also be concerned about unduly limiting genuine research access to sites dealing in socially unacceptable content, including that which is racist.

Libraries on the Internet

Libraries of all kinds are already on the Internet, and more seem to arrive daily. Online libraries do not meet the needs that traditional libraries do. For example, the vast majority of books are not available in digital form or online, and one is unlikely to find a reference librarian to help when searching for information on the Internet, except possibly by leaving an e-mail message. Nonetheless, online libraries can be very useful in meeting at least some information and assistance needs. This section gives an overview of some sites in California and the nation.

The California State Library's Web Site

The California State Library established a Worldwide Web home page[143] in 1995 concurrently with development of the California State Home Page (http://www.ca.gov).

The Library's site currently includes information about the Library and its services, the State Librarian's columns on California history and institutions, and information on other libraries in the state. It does not include links to such Web and Internet resources as the Gutenberg Project archives of public domain books, online catalogs, reference and statistical information (the CIA World Data Almanac, for example), and subject-area resources.

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[142] The same sort of question could be asked about government employees' use of Internet access, where many sites involve on-screen advertising. Personally, I simply ignore most that I encounter when doing research, but follow up on that which is related to research interests, as for example advertising that explains new technology.

[143] http://www.library.ca.gov/

Plans are already underway for revising and improving the site to reflect the rapid changes in the online environment.

The Library of Congress Online

The Library of Congress's Web site (http://www.loc.gov) offers a wide range of information. LOC provides access to its own catalog, to documents (including a remarkable and growing historical collection), to other Federal Government sites, to libraries (including the University of California catalog), and to search engines and other resources covering every imaginable topic.

Among the text collections posted on the LOC site are:

- Documents from the Continental Congress and the Constitutional Convention, 1774-1790
- The Evolution of the Conservation Movement, 1850-1920
- Life History Manuscripts from the Folklore Project, WPA Federal Writers' Project, 1936-1940
- African-American Pamphlets from the Daniel A.P. Murray Collection, 1880-1920

The Library of Congress provides MARVEL (Machine-Assisted Realization of the Virtual Electronic Library) and LOCIS (Library of Congress Information System):[144]

- MARVEL provides information by and about the Library as well as links to worldwide Internet resources worldwide, arranged in an easy-to-navigate hierarchical menu structure.
- LOCIS (Library of Congress Information System), gives Internet users access to more than 27 million records in the following files: Library of Congress Catalog, Federal Legislation, Copyright, Braille and Audio, Guides and Organizations, and Foreign Law.

Some Other Public Libraries on the Internet

Many state, university, and local libraries have Internet sites.[145] A few examples of these sites follow. Typically, libraries use their Web sites both to provide information about themselves and their services and locations and to provide links to other useful sites.

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[144] The descriptions of MARVEL and LOCIS are adapted from the Library of Congress's online documentation.

[145] Links to 34 state libraries (as of September 20, 1996) may be found at http://www.slis.missouri.edu/~state.html. Most are Web sites, although several are gophers. Gophers lack a graphic interface, but are otherwise similar in function to Web pages.

Sailor®, "Maryland's Online Public Information Network" (http://sailor.lib.md.us) provides links to information about Maryland as well as links to numerous research and reference topics. Sailor is an initiative of the Maryland Department of Education, Department of Library Development Services. The Sailor home page lists Maryland-specific options and the following "general interest" topics:

- Arts & humanities
- Business & consumer
- Children
- Education
- Employment & Career
- Entertainment & Recreation
- Government & law
- Health & medicine
- Internet & computing
- Libraries
- News & reference
- Science & technology
- Society & culture

In short, Sailor serves as a general-purpose online library.

The Queens Library System (http://www.queens.lib.ny.us/) is headed by former California State Librarian Gary Strong. The Queens Library Web site includes information about the Queens Library system and search options (in English and Spanish) for investigating the library's catalog, community resources, and Internet resources.

The Louisiana State University Library offers *Webliography: A Guide to Internet Resources* (http://www.lib.lsu.edu/weblio.html), which includes access, via e-mail, to reference librarians. The page is a subset of the LSU Virtual Library (http://www.lib.lsu.-edu/index.html). Some of the LSU resources are available only to LSU students, but

most are open to anyone. Among the site's highlights are Black History Month resources and a page devoted to Martin Luther King, Jr.

Other virtual libraries organize access to Internet resources through extensive sets of links, but, unlike sites for the Library of Congress, California State Library, and various university libraries, are not associated with a traditional, physical library. These include:

- The Argus Clearinghouse (http://www.clearinghouse.net/).
- The World-Wide Web Virtual Library (http://www.w3.org/pub/DataSources/).
- The Internet Public Library (http://www.ipl.org/).
- The Talbot County (Maryland) Arts Council (http://rio.atlantic.net/~sinclair/-bookmarx.htm).

Finally, the School of Library and Information Science at San Jose State University maintains a list of *Professional Organizations in the Information Sciences*, "a list of links to Internet sites maintained by various professional organizations in the library and information sciences" (http://witloof.sjsu.edu/peo/organizations.html). This is an enormous set of links covering all imaginable library resources.

Schools and Colleges

The Internet was available for research and educational use long before it opened up to commercial traffic o ı any significant scale. It has therefore had longer to develop *as* an educational resource and to penetrate the schools, especially at the college and university level.

Now that the Internet is not restricted to non-commercial use, its content has expanded to encompass resources not available previously. Some are paid services (The Electric Library, for example) and others are supported by advertising (many online newspapers and magazines, for example). Resources online serve the needs (even if unevenly) of students, teachers, and administrators at all levels from pre-school through post-graduate, not to mention adult learners not enrolled in formal coursework.

Internet in K-12 Education

One of the most talked-about areas of impact for the Internet has been kindergarten through twelfth grade (K-12) education. The "Net Day" phenomenon, in which volunteers wire schools for Internet access, has spread across the country. Californians have participated actively in that effort. The role of Internet access in K-12 education is very much in transition, as there is much to learn about how online resources may be applied in the classroom and about how use of the Internet may improve school outreach and accessibility.

The ways in which Internet access may serve education are quite varied, some directly involving students and others not. For example, schoolrooms can look toward internet resources for instructional assistance, to supplement textbooks, and for communications with other classrooms across town or around the world. Teachers and administrators may look to the Internet for lesson plans and for guidance on curriculum development and school management and may place their own materials on these subjects online for use by others, as the Internet is a two-way medium.

A growing number of classrooms now have their own Web pages, presenting information about student activities and interests.

The Internet may facilitate communication between teachers and their students, especially where special resource teachers serve multiple classrooms, schools, or even school districts. Further, parents may communicate with their children's schools and teachers and may get help online from educational resources provided by colleges, publishers, and others. Some parents might also post information on their own experiences (as, for example, on Usenet groups or in America Online forums) for the benefit of others or to get comments and suggestions on problems.

The Internet can serve the needs of kindergarten through 12th grade (K-12) education in many ways, some of which have already been mentioned:

- Classroom access to information online.
- Students' access from home or libraries, to supplement classwork.
- Parents' access from home or work, to contact teachers, check on school schedules, and so on.
- Students' access to their schools when ill or otherwise absent from class.
- Teachers' access to curriculum materials.
- Administrators' access to resources for managing their schools and functions.
- Exchange of ideas, information, and techniques among educators.
- Improved access to continuing education for teachers and administrators through collegiate "distance learning" programs.
- Supplementation of school library resources.
- Parent-teacher interaction.

Some of these uses require extensive technical resources (computers and wiring to enable access to the Internet) at the school, others do not.[146]

The move to incorporate Internet access poses risks and difficulties for K-12 education as well:

- Lack of well-developed and tested methods for using online resources in the classroom.
- Potential for wasting time in online activities of little or no educational benefit, or at least crowding out instruction and practice in more basic skills.
- Extensive and possibly unavoidable exposure to advertising on Web pages.
- Expense and difficulty of keeping up with technical standards and requirements, especially as multimedia applications become more common on the Web.
- The need to train teachers and administrators in a complex and rapidly changing technology--and demands on teachers to stay current with the technology and techniques.
- Difficulty of selecting the truly useful material from a sea of resources.
- Increased potential for plagiarism by students. Term-paper mills have already gone online, one posting its catalog on the Web and selling papers for $6.50 per page.
- Risks of computer theft at schools that buy the equipment but cannot afford campus security.

Of all of these, perhaps the most critical at this time is that teachers are not well prepared to use Internet-access technology, or even to use personal computers effectively.[147] In an informal discussion of the issue, San Juan Unified School District trustee Estelle Werve noted that teachers lack training in use of computers and in navigating the Internet. She also indicated that other demands on teachers leave little time or opportunity for development of expertise with computers in the classroom.[148] That district, however, does have a Web site, and has established at least a minimal presence on the Web for each of its schools.

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[146] Many examples of school and classroom use of the Internet are provided in Ferdi Serim and Melissa Koch, *NetLearning: Why Teachers Use the Internet* (Sebastapol, California: Songline Studios and O'Reilly Associates, 1996).

[147] The daughter of one California high school teacher told me, "My mom does not even know where the 'on' switch is on a computer."

[148] Personal communication, October 19, 1996.

A *Sacramento Bee* report on the second "Net Day," October 12, 1996, alluded to some of these issues:

> [T]he enthusiasm for what has been touted as a great technological leap forward also has been tempered in many school districts by practical concerns over obsolete computers, tight budgets[,] and a shortage of computer training for teachers.
>
> . . . . . .
>
> [E]ven with the hookups in place, most computers are ill-equipped for the information highway or the use of CD-ROMs, a concern voiced in several area school districts.
>
> "We find ourselves in an interesting situation," said Jim Potter, an assistant superintendent in the Rio Linda Union School District, which sat out Saturday's NetDay activities. "We've had a lot of computers donated . . . but a lot of them aren't able to do what we want."[149]

The onrushing presence of the Internet has outpaced the ability of public schools to respond entirely on their own resources. Private initiatives, however, loosely encompassed under the name "Net Day," have made some progress toward wiring schools for at least basic access. Like everything else having to do with the Internet, this effort, too, has its own Web site.[150] That site includes (or provides links to) information on progress made so far in states and localities, directories of resources, and even step-by-step instructions for wiring schools and classrooms. California's first Net Day took place in March of 1996, and a second on October 12, 1996. In some instances, unions have waived rules in order to allow volunteer Net Day assistance.

One concern about the movement to bring Internet access to the schools is that poor and minority neighborhoods are likely to be overlooked or reached last. If the effort depends on volunteers with the time, technical ability, and money to support the work, then it is likely (and experience is bearing this out) that more affluent areas and areas with a high proportion of technical expertise will be reached first. These are the areas that are also most likely to have many homes with computers and Internet access. To the extent that Internet access in fact contributes to an improved educational experience, a wide disparity in access between richer and poorer areas is a matter of public concern.

Colleges and Universities

Internet access has been available to many college students since long before the Internet came to wide public attention. Little need be said on that point here, as Internet access by college students does not pose the kinds of problems and issues posed by Internet access for K-12 students and schools. Internet-based resources are, however, obviously of immense potential value to college students, possibly even more so at this time than to

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[149] Jan Ferris, "Second NetDay at schools lacks some luster," *Sacramento Bee*, Oct. 13, 1996, pp. B1, 6.
[150] http://www.netday96.com.

elementary and secondary school students, given the range of literary, cultural, and historical documents, technical information, college and university library catalogs, and reference material available online.

Going beyond established types of college student access to information on the Internet, Governor Pete Wilson has announced plans for California to develop an online "virtual university." To this end, the Governor's office "is putting together a design team with advice from leaders at the state's public and private colleges and universities [including] university administrators, faculty[,] and students as well as leaders in finance, telecommunications[,] and information technology."[151] As of this writing, the proposal is only sketchy, although the online university is to begin to be operational by next spring, according to the *San Francisco Chronicle's* report. The Governor's initiative is an alternative to California's participation in a previously announced consortium of Western states. The other 13 states will pursue their own joint venture, the potential impact of which has been compared to that of the GI Bill after World War II.[152]

Development and management of an online university will require decisions about degree fields and courses, staffing, enrollment, instructional methods, record-keeping, accreditation, fees, marketing, authentication of the participating students (fraud prevention), and technical implementation (hardware, software, security, and telecommunications).[153] However, the online university can draw from experience, as UCLA already offers online courses in cooperation with The Home Education Network (THEN). Current courses (Fall 1996) include Accounting Fundamentals, Behavior in Organizations, Business Writing, Food and Beverage Management, and 13 others.[154] The University of California at Berkeley is also offering 25 courses in psychology, fiction writing, AIDS and film via America Online.[155] The *New York Times* cited institutions (including UCLA and UC Berkeley) currently offering coursework via the Internet.[156]

A private institution, the University of Phoenix, also offers extensive online programs, including a two-year MBA program. The school's founder (and chairman of its owner, Apollo Group, Inc.), John G. Sperling, "predicts that about half of the school's students will earn their degrees via the Internet in just a few years. Before long, a class of students, each at a computer in a different city, will use interactive video to communicate with their instructor, he said."[157]

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[151] Pamela Burdman, "California Wants Own Online University, Wilson Says," *San Francisco Chronicle*, October 3, 1996, p. A17.
[152] Attributed to Educom Vice President Carol Twigg, in the *Chicago Tribune*, October 28, 1996, as cited in *Edupage*, November 3, 1996.
[153] Detailed analysis of these issues is beyond the scope of this paper, although a future CRB publication may analyze the topic in depth.
[154] Information available at http://www.unex.ucla.edu.
[155] Maria Newman, "College Courses at Your Convenience on the Internet," *New York Times* (online edition), November 3, 1996.
[156] *Ibid.*
[157] *Ibid.*

Lifelong Learning

As it becomes typical for workers to have not only several jobs, but even several careers during a lifetime, continuing education is increasingly necessary. The Internet and the resources available on it could offer broad and deep assistance in coping with this need.

- Expanded opportunities for non-traditional students (older, part-time), especially those who must fit education in around job and family responsibilities or whose needs do not fit any of the established categories in colleges and universities. These opportunities need not involve formal degree or certification programs and may be tailored to individual needs and schedules.

- Non-campus-based formal education for "traditional" students pursuing a degree or certificate. Here, too, the flexibility offered by online programs could expand the opportunities for students in the typical age bracket for undergraduate and graduate programs (although those brackets have broadened in recent decades), as well as facilitating formal education for those returning to school after a time away for work or family. A new type of degree-granting institution could emerge to capitalize on the potential of the Internet. The online universities proposed by Governor Wilson and by the Western states governors certainly offer another alternative.

At this time, the key need in Internet-based education for learners not enrolled in formal programs appears to be for systematic means of finding, organizing, and accessing resources. There is an abundance of information online, as a stroll through the resources listed in and available through the "Selected Internet Sites" appended to this paper will prove. For those seeking to update their knowledge or explore new fields, though, there must be some guidance through the material. Formal coursework at a college, university, or technical school provides such guidance, but in a framework that may be too inflexible for many potential learners. That is, a counselor at, say, California State University, Sacramento, or at Sierra Community College can help a student develop a course schedule leading to needed knowledge, and teachers structure their classes to meet specific goals. But how does the individual achieve the same end if not enrolled in an institution that provides this much structure?

A student with extraordinary initiative and organizing skills might be able to successfully coordinate resources on his or her own, but how might this need be met for typical students who may not even know where to begin? There are many possible ways, encompassing private initiatives, public programs, and combinations of the two, and using both Internet resources and paper publications.

A full examination of this question would go far beyond the scope of this paper, but a few possibilities, focused specifically on Internet-based methods, include:

- Public library, college, and education department (federal and state) Web sites with subject guides and links to resources.

- Private college and university Web sites offering subject outlines, links to external resources, and a selection of on-site resources in a range of subjects.

- Commercial sites offering fee-based access to resource material, syllabi, consultation, and counseling.

Some combination of free and fee-based sites could provide opportunities for everyone who has access to the Internet and who wishes to pursue continuing education or independent learning. It remains to be seen whether and how well private enterprise will meet these needs and to what extent an active role must be taken by public institutions and agencies if the educational potential of the Internet is to be realized.

Policy Options

Libraries

- **State Library online services.** As increasing numbers and types of resources, including periodicals and reference materials, are offered in digital form, libraries need to encompass these resources as well as the traditional print media. In order to make these types of resource broadly available to the public, it may be appropriate to designate funding for the California State Library to provide proprietary information resources (such as reference works and full-text periodicals) to state officials and to the public via its Web site by arrangement with copyright holder/publishers.

- **Agency and department online documents.** In recognition of growing access to and use of the Internet for governmental information and services, the Legislature could require state departments and agencies to place their own libraries of reports, forms, and other public information on the Web as a matter of standard procedure.

- **Central resource for online document preparation.** To facilitate development of online documents, the state could provide a centralized service to state agencies that need to convert documents to a form suitable for posting online. Such a centralized service might allow economies in this processing and free individual departments from the need to each have such expertise and equipment.

K-12 Education

- **Availability in schools.** Internet-based resources have been demonstrated to be valuable in K-12 education, helping to meet needs of teachers, students, and administrators. However, not all schools and school districts yet have equal access to this technology. To the extent that these resources are productive in K-12 education, the state could take steps to encourage appropriate and equitable availability of Internet access in school classrooms, libraries, and technology laboratories.

- **Teacher training.** In view of increasing use of the Internet for educational purposes, the Legislature could encourage K-12 teachers to be trained in the use of Internet-based resources for classroom purposes. This training could encompass both the means of using the Internet for classroom purposes and an understanding of where Internet-based resources are and are not preferable to traditional resources. Knowledge of appropriate classroom Internet use could be included among teacher credentialing requirements and encouraged as a desirable qualification for promotion of current teachers.

- **Internet access for teachers and administrators.** If teachers are to be conversant and comfortable with Internet technology and resources, it is important that they have personal access to the Internet. To this end, the Legislature might consider a tax credit for home Internet access for teachers and administrators for purposes of training, school-related communications, and professional development.

- **Evaluation of K-12 Internet use.** The Legislature could commission or undertake a formal evaluation of K-12 educational use of the Internet in order to determine where school resources could be adjusted or redirected to make best use of Internet access, and to report to the Legislature on related findings and recommendations.

- **Online education clearinghouse.** There is an enormous amount of education-related information available online, but it is not necessarily easily found or used by those who need it. In order to facilitate use of available resources, the Legislature could direct the California State University system or the California State Department of Education to provide an online clearinghouse (Web site) helping teachers, administrators, parents, students, and the public to find and access education-related information.

Colleges and Universities

- **Online open university.** The Governor has already announced plans for an online "virtual university." In order to encourage continuing education among the broadest possible public, the Legislature could provide funding for a state "open university," with coursework, examinations, and resource materials available free online to anyone who chooses to access the information. Such a system could be run alongside a more formal online system that awards credit and requires registration and payment, as appears to be envisioned in the Governor's proposal.

CHAPTER 5: PRIVACY, FREEDOM OF SPEECH, AND INTERNET ABUSE

> "When every transaction leaves electronic footprints, pretty soon a computer knows things about us that we may want to keep hidden. I'm not talking about illegal things here, but simple stuff: a computer may know how much someone spent on liquor last week. How often I traveled to San Francisco. What phone calls I've made." (Clifford Stoll, *Silicon Snake Oil*, 1995)

The Internet can protect privacy through "anonymizers" and though pseudonymous screen names or user IDs. At the same time, however, the Internet and other computer technologies facilitate invasion of the privacy of individuals. This chapter outlines issues of personal privacy, freedom of speech, and risks to children and adults from materials and activities online. It then turns to Internet data security risks and types of misuse and abuse.

Personal Privacy

Computer databases have been widely used for decades and have posed controversial threats to the security and privacy of personal information.[158] Chapter 1025, California Statutes of 1996 (Senate Bill 1659, Peace and Calderon), cautions:

> (a) All people have an inalienable right to privacy as declared in Section 1 of Article I of the California Constitution.
>
> (b) Advances in technology have made it easier to create, acquire, and analyze detailed personal information about an individual.
>
> (c) Personal information, including information about a person's financial history, shopping habits, medical history, and travel patterns, is continuously being created.[159]

That bill established a "Joint Task Force on Personal Information and Privacy to make recommendations as to what changes to existing laws . . . are necessary to ensure that state law adequately protects the right of privacy and addresses the issues raised by the rapidly changing nature of information technology and systems." The Joint Task Force's findings and recommendations are to be compiled by the Legislative Analyst not later than March 1, 1998.

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[158] For one overview of the issues, see Ann Wells Branscom, *Who Owns Information: From Privacy to Public Access* (N.Y.: BasicBooks, 1994). Also see John V. Pavlik, *New Media and the Information Superhighway* (Needham Heights, Mass.: Allyn & Bacon, 1996), esp. pp. 277-81, and Smedinghoff, *Online Law*, Chapter 17, "Right of Privacy."

[159] From Section (1) of the bill.

The Internet has expanded access to information stored in databases and has made privacy concerns related to those databases more urgent, but it has not *fundamentally* changed the issues that already existed. Where the Internet does pose new issues and questions is in the use of online services themselves, as users' visits to Web sites may be logged, information observed in transit along the system, and patterns of information extracted from users' online activities.

This section summarizes some of the pertinent issues and methods affecting personal privacy on the Internet.

Sale of Data

The case that has generated the most publicity recently about privacy on the Internet is the Lexis-Nexis P-TRAK system. An e-mail chain letter circulated widely in the summer of 1996 reported that P-TRAK made personal information available to anyone with a credit card. The letter asserted that the file included Social Security number, credit histories and other financial information, addresses (current and former), mother's maiden name, phone number, birthdate, and other information. Lexis-Nexis responded to the chain letters and to press reports about P-TRAK, denying many of the allegations but ignoring others and confirming some. Lexis-Nexis, in a letter to the editor of the *Los Angeles Times*, explicitly denied that P-TRAK ever included "credit histories, bank account information, personal financial data, mother's maiden [name,] or medical histories."[160] Lexis-Nexis also emphasized that the system is a business-to-business service, available to subscribers only, not a consumer online service.

Nonetheless, P-TRAK does provide name of individual, current address, up to two previous addresses, month and year of birth, possibly the *individual's* maiden name,[161] and telephone number. In response to the flap, Lexis-Nexis removed Social Security numbers from the files only 10 days after initially including them in the files. Lexis-Nexis allows consumers to request removal from the database, and offers mail, fax, phone, and online methods for such requests.

Although all of the information in the P-TRAK file is publicly available (possibly at the cost of laborious research in public records), its availability online combined with the potential to link the information to other databases worries privacy advocates. Other information providers, for a sometimes substantial fee, "offer considerably more [personal data], including Social Security numbers, credit history and other personal information that would turn Sam Spade green with envy," according to a report in the *San Francisco Chronicle*.[162]

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[160] Posted at http://www.lexis-nexis.com/lncc/p-trak/ed.html.

[161] The distinction is critical, as mother's maiden name is often used to establish identity for credit account transactions.

[162] Julia Angwin and Jon Swartz, "P-Trak Defends Database," September 20, 1996, p. E1.

Tracking Online Activity

Internet users may think that what they do online is private, but they are wrong. Sometimes users knowingly give out information about themselves, as when they register for a site or complete an online questionnaire. Other times their visits and transactions are logged silently by the system they are visiting.

One means of tracking Web visits is the "Cookies" file. Quoting Netscape's concise but jargon-laden documentation of the concept:

> Cookies are a general mechanism which server side connections (such as CGI scripts) can use to both store and retrieve information on the client side of the connection. The addition of a simple, persistent, client-side state significantly extends the capabilities of Web-based client/server applications.[163]

To translate: "cookies" refers to a file placed on the user's hard disk. Under Netscape Navigator, the file is titled "cookies.txt." (If you are a Netscape user, look in your Netscape directory for the file, open it in a word processor, and take a look, but do not edit the file, as the file may be damaged if you do. Exit it without saving.) A "server side connection" is the business end of the Web transaction, so to speak. For example, if the user contacts the *New York Times*'s site, that site is the server (which means that it is serving information, or serving the visitor--the server provides service). A CGI (common gateway interface) script is a type of computer program used on the Web. The client side is the user's end of the transaction, his or her PC. A "persistent client-side state" is a set of information (a state) that remains in place (persists) between sessions. This is what enables a site to "know" a user's username and password for that site (if the user has requested that the information be stored on the local hard disk) and to track other information about that user. The information may be used to customize advertising displayed on the site for that user, to make specific features available, or to keep an accounting of usage or to track purchases from the site.

Servers need not access a cookie file to determine some information about a visitor to a site, as the user's IP address and browser enable the server to know the user's geographical area, possibly company affiliation, and operating system. But these are fairly innocuous pieces of information.

Users may find their activities tracked in other ways, although not necessarily by servers or even for commercial purposes. Conversations online (chat sessions) may be logged to disk by any participant or by a system administrator and forwarded to any e-mail address. E-mail may be copied and forwarded, as may newsgroup posts. In short, users should assume that anything they say or do online outside of secure commercial transactions is or could become public.

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[163] "Persistent Client State HTTP Cookies Preliminary Specification," http://www.netscape.com/-newsref/std/cookie_spec.html.

Online Anonymity and Pseudonymity

Notwithstanding the previous assertion, the Internet does offer ways for users to be anonymous or pseudonymous. While the ability to hide or disguise one's identity online may serve privacy, it also may enable or encourage intrusions into the privacy of others.

The largest of the online services (about seven million members as of December 1996), America Online, allows each account up to five "screen names," or user names. Screen names may not exceed 10 characters and must consist of numerals and letters (upper or lower case or a mixture). Each screen name may have an associated "profile" presenting whatever information the user wishes to place online for others to view. *There is no requirement that any of this information be truthful.* This system allows multiple users (members of a family, for example) to have separate online identities (screen names) under the same master account, each with its own password, e-mail address, and Web space. It also allows users to present themselves under completely phony identities, with occasionally pernicious results.

Internet Relay Chat (IRC) allows the user to select a nickname and to change it at will, although others on the system may query the system to find the user's account (for example, jsmith@localservice.net), somewhat limiting anonymity. The amount and accuracy of information available varies. Some users of IRC might be easily traced by someone who chooses to do so, and others not traceable at all. In any event, at this point, it appears that IRC has been eclipsed in popularity, at least in the U.S., by AOL, Prodigy, and other services with chat features.

It is possible to use fraudulent return addresses on e-mail, a technique frequently used by spammers (junk e-mailers, see below) to prevent a barrage of angry responses or by individuals wishing to hide their identity.[164]

Anonymous remailing services (anonymizers) also facilitate anonymity by stripping identifying information from e-mail and resending with only a code number and the return address of the anonymizer. The most prominent and popular of these services, located in Finland, closed as a result of assertions that the site harbored pornographers (a charge that the proprietor disputes) and in response to requirements that the proprietor provide information to the Finish authorities about users of the system charged with crimes or copyright infringement, thus violating the assurance of anonymity.

One of the reasons for anonymizers and other methods of assuring anonymity is that some Internet users use e-mail, newsgroups, IRC, and bulletin boards to discuss sensitive topics and to participate in support groups. Issues include, for example, health concerns (cancer, communicable diseases, mental health), drug abuse, and sexual orientation. At the same time, however, anonymity can protect those who wish to harass participants in gay- and

[164] The techniques and their limitations are beyond the scope of this paper.

lesbian-oriented newsgroups or to intrude on people seeking support for cancer, drug addiction, or depression.

Junk E-Mail: Who Owns your Internet Address?

One of the most publicized and acrimonious disputes on the Internet is over unsolicited commercial e-mail, known as "spam" or junk e-mail to those who dislike it.[165] Spammers (bulk commercial e-mailers) argue that they are entitled to send e-mailings just as users of the Postal Service are entitled to send commercial material to mailing lists. They also maintain that bulk e-mail is ecologically sound, as it saves paper, and that e-mail addresses are public information, just as street addresses are. Even with very small response rates, bulk commercial e-mail appears to be sufficiently profitable to keep its practitioners in business.

The analogy of bulk e-mail to bulk postal mail breaks down in that paper mail is easily sorted and disposed of (albeit at a waste of paper), while bulk e-mail may be costly to the recipient and, if received in large enough quantities, may make an e-mail box unusable. Those who have metered (non-flat-rate) e-mail may have to pay for the time required to sort, read, download, or delete unwanted e-mail. Further, spammers typically use phony return addresses, preventing unwilling recipients from even responding to the spammer to complain. Spammers argue that they provide a means of getting off of their mailing lists, but using the removal feature may be time-consuming and difficult, and the spammed maintain that the removal requests are ignored.

America Online, CompuServe, and other online services have sought to block junk e-mail and to kick spammers off their systems. Although America Online and others have won in the courts (pending further appeal), the onslaught of bulk e-mail continues, and the issue remains unresolved. E-mail filters offer some relief to beleaguered recipients, but spammers continue to change their network addresses to defeat filters at least temporarily.[166]

Freedom of Speech on the Internet

Speech on the Internet encompasses many facets, not all accorded the same weight under American law and treated even more diversely elsewhere in the world. These facets are as diverse as commercial speech, political speech, and "adult material." Courts have ruled that protection of free speech is as important on the Internet as it is in any other venue.[167] Yet what is available to one user online is available, directly or indirectly, to all, every-

[165] The term "spam" is derived from a Monte Python Flying Circus skit that features prominent and repetitive references to Hormel's familiar delicacy.
[166] There is a Web site devoted entirely to "Beating the E-Mail Spammers": http://www.cciweb.com-/iway7/spam.html.
[167] For example, with reference to the Communications Decency Act. See below.

where in the world. No Internet governing body determines what content is and is not acceptable online.[168]

May restrictions on speech on the Internet *exceed* those imposed on other media? May restrictions be imposed on Internet postings *comparable to* restrictions imposed on other media? Fraudulent securities data and defamatory statements[169] are not protected on the Internet any more than they are when printed in newspapers or in circulars distributed via the Postal Service or spoken on a radio or television program. Legal redress is available against such postings in any format or medium, so the Internet does not raise fundamental new issues in those areas, although it may extend the reach of securities scams and libel.

The Internet allows material posted on a host computer in one jurisdiction to be immediately accessible from everywhere else in the world, including places that might take a very different view of the acceptability of the material in question or that are not reached by the legal system. Should the restrictive policies of one nation or area affect rights to post images or documents in another? This is a question that *ultimately* must be resolved through international agreement or worked out in practice, but that cannot be decided by any local or national jurisdiction acting alone.

Nonetheless, the United States Congress has attempted, via The Communications Decency Act of 1995 (CDA), to regulate certain aspects of speech on the Internet. CDA, part of the Telecommunications Act of 1996 (Public Law No. 104-104, 110 Stat. 56 [1996]), reads in part as follows:

> Section 223 (47 U.S.C. 223) is amended -
>
> (1) by striking subsection (a) and inserting in lieu thereof:
>
> "(a) Whoever --
>
> "(1) in interstate or foreign communications -
>
> "(A) by means of a telecommunications device knowingly -
>
> "(i) makes, creates, or solicits, and
> "(ii) initiates the transmission of, any comment, request, suggestion, proposal, image, or other communication which is obscene, lewd, lascivious, filthy, or indecent, with intent to annoy, abuse, threaten, or harass an other person;

[168] Network administrators and ISPs may, however, exercise such judgment. For example, the president of one Sacramento ISP told me that he had removed a pedophilia-oriented newsgroup from his server, and America Online requires subscribers to adhere to Terms of Service limiting what they may say, do, and post on the system.

[169] Defamation is *libel* if in print, and *slander* if spoken. (*Black's Law Dictionary*, Revised Fourth Edition.)

"(B) by means of a telecommunications device knowingly -

"(i) makes, creates, or solicits, and

"(ii) initiates the transmission of, any comment, request, suggestion, proposal, image, or other communication which is obscene or indecent knowing that the recipient of the communication is under 18 years of age regardless of whether the maker of such communication placed the call or initiated the communication;

"(C) makes a telephone call or utilizes a telecommunications device, whether or not conversation or communication ensues, without disclosing his identity and with intent to annoy, abuse, threaten, or harass any person at the called number or who receives the communication;

"(D) makes or causes the telephone of another repeatedly or continuously to ring, with intent to harass a person at the called number; or

"(E) makes repeated telephone calls or repeatedly initiates communication with a telecommunications device, during which conversation or communication ensues, solely to harass any person at the called number or who receives the communication;

"(2) knowingly permits a telecommunications facility under his control to be used for any activity prohibited by paragraph (1) with the intent that it be used for such activity,

shall be fined under title 18, United States Code, or imprisoned not more than two years, or both."; and

(2) by adding at the end the following new sub sections:

"(d) Whoever --

"(1) in interstate or foreign communications knowingly -

"(A) uses an interactive computer service to send to a specific person or persons under 18 years of age, or

"(B) uses any interactive computer service to display in a manner available to a person under 18 years of age,

any comment, request suggestion, proposal, image, or other

> communication that, in context, depicts or describes, in terms patently offensive as measured by contemporary community standards, sexual or excretory activities or organs, regardless of whether the user of such service placed the call or initiated the communication; or
>
> "(2) knowingly permits any telecommunications facility under such person's control to be used for an activity prohibited by paragraph (1) with the intent that it be used for such activity,
>
> shall be fined under title 18, United States Code, or imprisoned not more than two years, or both.

Opponents of the CDA have asserted that the law is unconstitutionally vague and inhibitory of free speech, a position with which federal courts have agreed. A panel of three federal judges in Philadelphia granted a preliminary injunction against enforcement of the CDA in June of 1996, and a second panel in New York also enjoined the act. The Justice Department appealed the decisions, and the appeal is now pending with the Supreme Court, which has agreed to hear the case.

A *New York Times* report on the New York decision summarized:

> The judges said that if it stood, the new law would restrict freedom of speech in this new forum, chilling constitutionally-protected speech between adults. The judges said that current technology does not allow most electronic publishers to ensure that children will be excluded from viewing indecent communications. Therefore, they wrote, the only way for adults to protect themselves from the possibility of being charged with a crime under the statute "would be to refrain from transmitting any indecent content," something that was "unquestionably" unconstitutional.[170]

Authorities in China, Kuwait, and Singapore have sought to block access for their citizens to Internet sites with information (text, graphics, audio, video) deemed unacceptable on political or cultural grounds. The Kuwaitis, for example, are concerned about "material inducing sin . . . [or] breaching our belief and values . . . ."[171] Internet users with some expertise can work around restrictions, making it doubtful that attempts to block access can succeed in the long run. Attempts to block the access of any local area within the United States to any part of the Internet would probably be doomed to instant failure. Residents of the most conservative rural township can access any site on the Net, just as can citizens of densely populated urban areas. This makes the question of "community standards" difficult, as the concept of community is changing before our eyes.

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[170] Pamela Mendels, "Second Federal Panel Declares C.D.A. Unconstitutional," July 30, 1996, http://www.nytimes.com/library/cyber/week/0730cda-ny.html.

[171] Reuters report, "Kuwaiti MP Seeks curbs on Internet," http://www.sjmercury/com/whatsnew/-015201.htm, posted August 28, 1996, 07:11.

Local authorities in other nations might have a better chance of prohibiting their citizens from posting disapproved material online, but even that may be very difficult to enforce. "Anonymizers" (e-mail remailing services that disguise the sender's identity) allow posting of messages anywhere that accepts anonymous messages (Usenet groups, for example), and those sites may then be accessed online. A citizen of The People's Republic of Dystopia could post an anti-regime message via anonymous remailing service on, say, alt.politics.dystopia.boo.hiss,[172] and that message could then be viewed by other Dystopians with Usenet (newsgroup) access. The Dystopian authorities might have a law against such speech, but are unlikely to be able to enforce it in practice, certainly not before the fact.

The Center for Democracy and Technology, in cooperation with other organizations, has begun an effort it calls the World Internet Freedom Project, to "seek workable solutions to the increasingly aggressive efforts of foreign governments to regulate online communications."[173]

Protecting Children from "Adult" Material

One of the most frequently expressed concerns about the Internet, and one of the sources of the Communications Decency Act, is the risk it poses of exposing children to sexually explicit and otherwise offensive material. An enormous amount of such material is available online especially in the "alt.sex" Usenet groups and sex-oriented Web sites. Some is freely available to anyone on the Net; some requires registration and even credit card information before access is provided. Much can be easily found in minutes (or less), sometimes in surprising ways.

For example, I searched for information on the child-protection software called "SurfWatch." Among the sites mentioning SurfWatch quickly found by the Altavista search engine were several explicit, hard-core adult sites and pages of links to such sites. One of them included numerous links to adult sites, most of which were Usenet groups readily available to anyone. Another was an adults-only site that required registration and credit card payment to access its contents beyond opening screens and descriptions. In short, even someone looking for software to protect against adult site availability can quickly be *led* to hundreds of adult sites--one need not even be looking for those sites.

Many (probably the vast majority of) adult-oriented Internet sites require payment to view or download files. This automatically tends to filter out underage Internet users, as a credit card or advance establishment of a prepaid account is required for access. This may change with the arrival of electronic cash--even children may be able to obtain digital cash

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[172] This, by the way, is pronounced "alt dot politics dot dystopia dot boo dot hiss." The period is usually pronounced "dot" when a Usenet group name, URL, or e-mail address is read aloud. And for those who wonder, "URL," meaning "universal (or uniform--take your pick) resource locator," is often pronounced *earl*.

[173] CDT "First Annual Report and 1996 Work in Progress, March 1996," http://www.cdt.org/publications/annuals/96_report.html#privacy_forum_act.

or smart cards as easily as they may now buy prepaid phone cards. Electronic cash could enable children to visit sites that would otherwise effectively be off-limits. Some sites do make use of a system for prior verification of the user's age, but there is no requirement that they do so.

Private enterprise is seeking to meet the need and desire for software to limit access to adult sites online, although it seems likely that other vendors or creative computer users will quickly follow with programs or methods to get around the protection systems.

Predatory Behavior

The presence of predators on the Internet has been documented repeatedly in the newspapers. For example, in August 1996 a young teenage girl was lured to California by a man she had met online. He persuaded her to steal her parents' credit card, buy a plane ticket, and fly to Sacramento. There he met her, took her home, and had sex with her. They were tracked down quickly and he has been charged with statutory rape. This is only one example among a number that have been reported in the press.

Pedophiles and child pornographers meet on the Internet, exchange files, track actual or potential victims, and plan assaults. In at least one case, child molestation sessions were telecast live via the Internet to distant sites.[174] The *New York Times* reported on an extensive computer database of thousands of children, maintained by an imprisoned child molester:

> . . . [C]hildren appear [in the database] by name, age and location in dated entries that span six years and include personal details written as "latchkey kids," "speech difficulties," "cute" and "Little Ms. pageant winner." Those on the list range from babies 1 month old to children in their early teens, but most are girls between 3 and 12.[175]

Records discovered by investigators in the case show extensive use of the Internet to exchange messages and images. California law prohibits the knowing transmission of child pornography by any means, including via computer hardware or software.[176]

Predators have also taken advantage of adults online. There are cases (possibly many) of online acquaintances in proprietary network chat rooms (AOL, Prodigy, CompuServe) and on Internet Relay Chat leading to stalking and other forms of offensive behavior or worse. While such activities do not require network communications, Internet may be providing expanded horizons for sociopaths. It is not clear what preventive measures are

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[174] "Police arrest man linked to child-porn ring," *San Jose Mercury News*, November 4, 1996, as posted on the *Mercury News* Web site.
[175] Nina Bernstein, "On Minnesota Prison Computer, Files to Make Parents Shiver," *New York Times*, November 18, 1996 (as posted on the *Times* Web site).
[176] Chapter 1080, Statutes of 1996 (AB 295, Baldwin); see §311.1 of the *Penal Code*.

available that would be more effective than a highly developed sense of caution on the part of those who chat online.

In one widely publicized and especially alarming case, a 35-year-old woman arranged online to meet a man with whom she had discussed explicit sexual fantasies in a sex-oriented chat room. The meeting resulted in the woman's torture and death, outcomes she apparently expected.[177] In another extreme case, a young woman was tortured and sexually abused by a man she met online and got together with in person for dinner and videos.[178] Other cases have involved men befriending women online, arranging to meet them, sometimes under the pretext of pursuing a long-term romantic relationship, and abusing or otherwise taking advantage of them, sometimes under false identities.[179] These situations are fostered both by the Internet's ability to disguise identities and the (often false) sense of intimacy that may develop through online conversations.

Digital Fraud and Vandalism

The ability to edit audio and video digital images permits fraud of a type previously impossible. Photographs, moving pictures, and sound clips can be altered and even created virtually out of whole cloth to present events that never happened, or at least never happened *that* way. This danger would be quite enough by itself, but is now amplified by the speed with which such images may be transmitted and retransmitted over the Internet. An entire speech or event could be fabricated and, in effect, broadcast to the world. How, then, are images to be authenticated? Or can they ever be? This is not entirely a new issue, but one made potentially much more urgent by the difficulty of detecting digital fraud and the immense power now available for disseminating images.

Not only may specific images or documents be altered, so may entire Web sites. In mid-August of 1996, a malicious hacker (often called a "cracker") invaded and altered the U.S. Department of Justice Web site. Among other things, the invader changed the logo to read "Department of Injustice," inserted a tirade against the Communications Decency Act, and added to the page a topless picture of a Jennifer Aniston ("Friends" star) lookalike. Justice quickly shut down the site for repairs. In September, a similar attack took place on a CIA Web site, although the site reportedly had no connection to secret CIA files or computers.

If an entire Web site could be so radically altered, an act easily discovered--in fact designed for that purpose--how many sites might have been subtly altered through a

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[177] On this case, see, for example, Alex Dominguez, "Internet attracting sexual predators," *San Jose Mercury News*, October 21, 1996 (as posted on the *Mercury News* Web site).

[178] Rachel L. Swarns, "Student Accused of Assaulting Woman He Met in Online Chats," *New York Times* (online edition), December 8, 1996.

[179] I am aware of several such cases from online discussions, but those have to be considered apocryphal, as I do not have first-hand documentation, although I do consider the reports to be accurate. Nonetheless, there are sufficient reports online and in the media to suggest that such cases are not rare. I do know one individual (male) who was the victim of a comparable hoax by a married woman who posed online as divorced.

change in an embedded URL, alteration of a statistic, or modification of a written passage? Such subtle changes might go unnoticed until damage had accumulated over a long time.

Posting of fraudulent documents (doctored versions of published works, bogus reports, and so on) is well known on the Internet.[180] In a notorious recent incident, widely reported in the press, news correspondent Pierre Salinger announced that he had found evidence that an errant missile had brought down TWA Flight 800 in July of 1996. Salinger had been fooled by a long-discredited document that had circulated on the Internet. Salinger's claim was widely distributed before the fraudulent source of the document was learned.

Bogus Web sites sometimes appear, giving the impression of authority or official sponsorship. For example, a fake Bob Dole campaign site, www.dole96.org (in contrast to www.dole96.**com**, which was the genuine site), parodied the Republican presidential candidate, and in turn linked to other potentially misleading parody sites. Because search engines index sites on the basis of the words in them, anyone can create a misleading or outright fraudulent site, including words or phrases that will eventually draw visitors, attract links, and gradually spread rumor or innuendo about a selected target. Sky Dayton, founder of the ISP "Earthlink" was a victim of such a process, implying that Earthlink was controlled by the Church of Scientology, of which Dayton is a member.[181]

Viruses, Trojan Horses, and E-Mail Chain Letters

Malice on the Net also takes the form of viruses, Trojan horses, and fraudulent messages modeled on the chain letter.

A *computer virus* is a (usually, but not necessarily) destructive program that replicates and spreads from computer to computer. Computer viruses now number in the thousands, with new variations appearing daily, or so it seems. A battle is underway between creators of viruses and creators of virus-stopping programs, such as Norton Anti-Virus.

A *Trojan horse* is a destructive or annoying program disguised as a useful or benign piece of software. When executed, the program might destroy data, alter file contents, put an annoying message on the screen, or even erase an entire hard disk.

Recently a third variety of malice has taken the form of *"warnings" about non-existent viruses and Trojan horses*. These warnings spread in chain-letter fashion, passed along by well-meaning but credulous users of Internet and online services. The most notorious and widespread of these warnings pertains to the so-called "Good Times Virus." This is purported to be a "virus" originated on America Online and embedded in messages with subject line containing the phrase "Good Times." Once started on its way, this hoax was

[180] Also see the discussion of commercial fraud in Chapter 2, above.
[181] Robert Wright, "The Cybersmear," *Time*, July 8, 1996, p. 46; the article is an excerpt from online magazine *Slate*.

passed around and around, often posted to newsgroups and e-mailed to lengthy lists of recipients. The only "virus" here is *the warning itself*, replicated endlessly around the Net, cropping up anew every few months and starting its rounds again.

A variation on this theme is the "Stevie and Amanda" e-mail message. This is a purported plea from school children Stevie and Amanda that the recipient reply to a specified address, and pass the request along to as many additional e-mail users as possible. The alleged Stevie and Amanda are said to be pursuing a school project and seeking to find out how many replies they can get within two weeks. However, as no date is given in the message, the "request" can circulate on and on forever, and has been seen to recur at intervals on the same discussion groups. There is no way of knowing how many credulous recipients have been duped by this scam or how many copies of the request have flooded Internet.

Another classic chain-letter hoax is a purported report of a woman who was grossly overcharged for a cookie recipe (the details vary, although Neiman-Marcus is often cited as the culprit) and who retaliated by posting the recipe online. The message is e-mailed with a request that the recipient pass it along to everyone he or she knows online. That one has been circulating in this fashion for years.

In general, a message's inclusion of a request that the recipient forward it to all of his or her online acquaintances and its posting to news groups and mailing lists should be considered a sign that it is a hoax.

Denial of Service Attacks and "Cancelbots"

In September of 1996, a "denial of service" attack on Public Access Networks Corporation (known as Panix), brought sudden attention to this destructive type of online assault and to the system flaw that permits it. A denial of service attack floods a Web site with requests for connection but cuts short the response and acknowledgment process, thus leaving a growing queue of requests on the server. The server is quickly overwhelmed and becomes unavailable. As the attacker can continue the attack (disguising the source), the site may be put out of service for hours or days.

Instructions for this type of attack were published in a periodical designed for computer hackers and others interested in the technology, and quickly were disseminated around the world. The Panix attack appears to have been a response to Panix's actions in stopping spammers from mailing to the company's subscribers, although similar attacks have been reported on other Web sites.[182]

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[182] See, for example, Robert E. Calem, "New York's Panix Service Is Crippled by Hacker Attack," *New York Times* (online edition), September 14, 1996; Joshua Quittner, "Panix Attack," *Time*, September 30, 1996; Louise Kehoe, "Rash of hacker attacks worries Net users," *San Jose Mercury News*, September 18, 1996, as posted on the *Mercury News* Web site. According to Calem, the denial of service instructions were published in the Summer 1996 issue of the periodical *2600*.

There is no easy, reliable, or widely available method for stopping denial of service attacks, although Internet technical experts are working on solutions.

Another sort of online mischief is the "cancelbot,"[183] a program that seeks out and deletes specified messages on Usenet groups. Cancelbots have been launched from time to time to wipe out large numbers (a hundred thousand or more) of posted messages across the numerous servers on which copies are stored. The technology started out as a benign method for deletion of an erroneous or out-of-date message, and was adapted to allow its use essentially as a weapon against free speech on the Internet.

Policy Options

- **Protection of minors.** One of the foremost public concerns about the Internet is the potential threat it poses to children, especially in the areas of sexual exploitation (as defined in Section 11165.1. of the *Penal Code*) and exposure to obscene or harmful matter (as defined in Sections 311 and 313 of the *Penal Code*, respectively). The Legislature could strengthen protections for children using the Internet by explicitly extending prohibitions of lewd and lascivious acts against children to include comparable acts committed with minors in online chat rooms or by any similar means. Such a provision could be comparable to Section 288 of the *Penal Code*.

- **Safety instruction.** The best protection for children using the Internet is for them to know and use precautions that help to assure their safety and privacy. The Legislature could require the public schools to teach safety rules for online activity.

- **Protection of Internet data.** The Legislature could explicitly prohibit the unauthorized alteration of any Web site or document posted online. Such a prohibition could be comparable to Section 620 of the *Penal Code*, which prohibits the willful alteration of "the purport, effect, or meaning of a telegraphic or telephonic message to the injury of another."

- **Prevention of online vandalism.** The Legislature could explicitly prohibit, and where appropriate increase penalties for, malicious online activities, including e-mail bombs, denial-of-service attacks, and knowing dissemination of viruses and Trojan horses. Such a prohibition could be comparable to the provisions of Section 594 of the *Penal Code*, prohibiting the defacement, damaging, or destruction of real or personal property.

[183] A "bot" (the name is derived from "robot") is a piece of software designed to automate some task on the Internet. Some are quite useful, replying to inquiries posted to specialized IRC channels (chat rooms), for example. Others, including cancelbots, are annoying or destructive.

CHAPTER 6: IMPROVING ACCESS TO THE INTERNET

"One of the soundest rules I try to remember when making forecasts in the field of economics is that whatever is to happen is happening already." (Sylvia Porter, financial columnist)

If the Internet is really becoming a necessary part of daily lives, work, and education, then access to the Net is a public concern. This chapter looks at some of the barriers to access and some ways of easing or improving access.

What Gets in the Way of Access?

Cost

Even the least expensive home computer suitable for accessing Internet and the Web costs around $1,000. Current systems typically sell for as much as $2000 or more. Online services currently charge $10 to $30 per month, and access may also entail long-distance or local toll charges that can accumulate quickly. These are affordable expenses for the middle class, especially where they provide identifiable benefits (value in work, education, or entertainment). For the poor, however, those costs could prevent home access to Internet services.

Location

Rural areas have less access (or at least considerably more expensive access) to Internet services. They also have less access than urban areas to assistance in dealing with technical problems and to equipment and software.

Culture, Race, Ethnicity

The Internet is heavily oriented toward English. Those who are not comfortable with English will not be comfortable navigating the Web and will find comparatively little of use or interest. Culture, race, and ethnicity as such are otherwise largely irrelevant to access, as suggested by growth in Web sites featuring minority group interests. See, for example, the "Ethnic and Minority" section of the "Selected Internet Sites" in the appendix to this paper.

Gender

Until recently, the Internet was predominantly used by men. Women frequently reported harassment in news groups and Internet Relay Chat and were greatly outnumbered by men online. In the recent years, however, increasing computer expertise among women, the active marketing of America Online and other online services and those services' addition of Internet access, and the expansion of the Worldwide Web have improved the environment and may have largely erased women's disadvantages online.

Age

While age as such is not a barrier to use of computers or the Internet, older people are less likely than younger ones to be familiar with the technology, having not been raised with it and possibly having not been exposed to it at work. To some extent, age may be associated with reduced economic ability and incentive to use new technology, especially in the home. On the other hand, for older people internet access can facilitate finding information and other activities made more difficult by reluctance or inability to drive or other impediments. Further, older people, especially those who have retired, may have time for exploring the Internet that people with young children, full time jobs, or both may not.

Blindness

Reliance of Web-browsing software and of many Web sites on icons (graphic images) rather than text is a barrier to the vision-impaired. Text-to-speech software can read on-screen text aloud, enabling blind people to work with text-based screens. Icons, if not supplemented by well designed text, are an insurmountable barrier at this time. A report in the *Wall Street Journal* suggests that a breakthrough may be coming within a year, as Microsoft is putting resources into addressing the issue. In the meantime, many "speech-friendly" sites are available. Text-to-speech software can read the contents of these sites aloud over speakers attached to the computer, enabling blind users to navigate the sites and listen to articles, reports, and other materials. One Web site, called "Cathy's Newsstand" provides links to many speech-friendly sites.[184]

Easing Access to the Internet

Several developments have eased access to the Internet. These developments encompass changes in pricing, new types of access devices, and initiatives undertaken by government, nonprofit, and commercial organizations.[185]

Low-Cost Internet Access Devices

WebTV, at $329 (plus $20 monthly charge for service plus $69 for optional keyboard) could be a satisfactory substitute for a $1,000 to $2,000 PC for those who seek Internet access but not the other features and capacities of a modem-equipped PC. The Sega Saturn Net Link device, mentioned in Chapter 1, is another relatively low-cost alternative.

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[184] Cathy's Newsstand: http://www2.cdepot.net/~mist/.

[185] The Public Utilities Commission has adopted standards for "universal access" to telecommunications services, although the PUC's definition of that term does not yet include Internet access. The Federal Communications Commission on November 8, 1996, issued a massive "recommended decision" regarding universal access (FCC 96J-3) that touches on Internet access, but that decision came too late for review for this paper, and in any event is subject to modification before it is adopted. A follow-up paper by the California Research Bureau will examine state and federal universal access requirements and proposals and their relevance to Internet services.

The entire package is available for around $450 (excluding a TV set, needed for display), although some users may want to add options at extra cost, and Internet access service must be purchased.

Declining Fees for Access

Competition among Internet access providers is expected to reduce prices, possibly by an order of magnitude. A report in the *San Jose Mercury News* cited a prediction that Internet access would in time be "a $2 add-on to your phone or cable bill."[186] Whether that is so or not, anecdotal evidence seems to indicate that to make Internet access broadly attractive in the U.S., it will have to be priced at or below about $15 per month. The pool of people willing to pay significantly more (for personal use, at least) may have been largely exhausted.

America Online has gone to a flat-rate pricing scheme, $19.95 per month for unlimited time. Until that change, effective in December 1996, AOL charged $2.95 per hour once the "free" time included with the regular monthly fee was exhausted.[187] The day the AOL flat rate took effect, the service saw unprecedented usage levels that led to slowing of service, inability to access the service, and disconnections, suggesting that there is a ready market for the new pricing scheme. As of January 1997, heavy use of the system still made access difficult.

The Microsoft Network is available, with limited hours of use, for as little as $4.95 per month. AT&T's Worldnet offers a comparably inexpensive low-use option.

If combined with a lifeline phone rate or economy basic cable rate, a small additional fee for Internet access could easily be affordable for even for people on very limited incomes. Whether such a low, flat-rate system will in fact come become common is disputed. MCI's director of Internet marketing describes flat-rate systems as "a very unhealthy model for the longevity of the Internet," as the revenues generated by the flat rate cannot keep up with costs of providing service.[188] This, however, appears to be a question that the market will decide and currently is deciding in favor of flat-rate pricing.

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[186] Brett Glass, chairman of a Laramie, WY, non-profit ISP, quoted in Jody Mardesich, "Fee changes for online services may thin out ISPs," *San Jose Mercury News* (online edition), October 9, 1996.

[187] Until that change, AOL had two plans. One allowed five "free" hours for a $9.95 monthly fee, and the other allowed 20 "free" hours for a $19.95 monthly fee. In each case, additional hours were $2.95 each. Under the first plan, one hour per day of access in a 30 day month would cost a total of $83.70 for the month; under the second plan, that usage would cost a total of $49.45. Flat-rate ISP services, typically at less than $20 per month, are actively competing with AOL and similarly priced providers, and can be expected to continue to do so as content available free on the Web continues to improve and expand.

[188] David Bowermaster, "Flat-rate fees may bite the dust," posted at www.msnbc.com, October 11, 1996.

Public and Nonprofit Access Providers

Just as public libraries make books, periodicals, and other printed information resources available to the public, libraries and other organizations may provide public access to Internet resources. For example, LINCT, the Learning and Information Network for Community Telecomputing,

> . . . is a not-for-profit coalition of socially-concerned organizations--working with affiliated businesses and local governments, libraries, schools, and social services--to help communities achieve universal, equitable access to integrated, community-wide electronic information and leaning services . . . LINCT helps communities to recycle used business computers to poverty-level and low-income families and seniors who may earn them by learning how to use them through training provided by volunteer computer-literates at local community centers and/or libraries and schools.[189]

LINCT has been active in New York City, upstate New York, and seven other states.

Increasing numbers of library sites offer public access to the Internet. The *New York Times*, in August 1996, described access available at the Brooklyn Public Library, the Queens Borough Public Library, and other public libraries in New York. Microsoft Corporation, in partnership with the American Library Association, has helped to fund library Internet access through a program called "Libraries Online!"

Of more direct interest to California, the California State Library, through its InFoPeople Project, has assisted local libraries in connecting to and making use of the Internet. The purpose of the project is "To encourage the development of public access to the Internet at public library sites throughout the State of California." Over 180 libraries are participating in the project, which offers equipment, training, and Internet connect time:

> In each library, a lead staff member and community partner are responsible for experimenting with a variety of public uses of the Internet, training others, sharing their experiences with each other and other libraries, and making recommendations for long-term Internet access and use.

The project is funded by the Federal library Services and Construction Act, administered in California by the California State Librarian.[190]

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[189] From post at http://www.IntNet.net./pub/COMMUNITY/LINCT.community.resources, dated October 5, 1994, and accessed September 9, 1996. As of September 9, 1996, additional information on LINCT could be found at http://www.the-hermes.net/~shoshona/Welcome.html.

[190] From http://www.lib.berkeley.edu:8000/project.html.

Libraries for the Future has described the program this way:

> Involving a diverse group of libraries, including the Alpine County Library in Markleeville as well as the Watts Branch of the Los Angeles Public Library System, InFoPeople has taken a unique approach toward equipping libraries with resources to connect to the Internet. Unlike other statewide programs that focus on wide area networks to link libraries together and then to the Internet, InFoPeople opted instead to provide the resources for individual libraries to directly establish their own independent Internet connections.[191]

The Seaside Public Library, one of the participating local libraries, describes its InFoPeople role:

> Our project has been the model for the 180-some libraries that have received computers under the InFoPeople grant. Our trainers have conducted public demonstrations and presentations to numerous groups and are currently involved in many Internet projects.
>
> The program has received visitors from many areas of the State, has hosted the State Librarian, was visited by representatives of Blacksburg Electronic Village (Virginia), has made guest appearances on radio and TV programs, and is looking forward to hosting the annual meeting of Pac Bell's State-wide Education First Advisory Board in February. If it sounds like we are proud of what this library has accomplished, it's because WE ARE![192]

Corporate Initiatives

Corporate initiatives are helping to make advanced telecommunications and Internet access services available to schools and nonprofit organizations.

For example, Pacific Bell, in 1993, created "CalREN, a $25 million program to stimulate the development of new applications for high-speed data communications services." PacBell conducted a competition to designate projects under CalREN, ultimately funding an array of projects centered in the San Francisco and Monterey Bay areas and in the greater Los Angeles area.. According to a PacBell spokesman, "The CalREN project submission cycle ended in March, 1994. No further project solicitation efforts are currently planned."[193]

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[191] From description of InFoPeople at Libraries for the Future site, http://www.lff.org/technology/-infopeo3.html.

[192] From report posted at http://bbs.ci.seaside.ca.us/sealib/reemailq.htm.

[193] Information from e-mail message from Jeff Griffin, September 6, 1996, supplemented by examination of online list of projects.

The following illustrate the types of projects funded by CalREN:[194]

> Sharing Medical Expertise: Many community hospitals lack expertise in special fields like neurosurgery. In northern California, Sutter Solano Medical Center teams with John Muir Medical Center and local neurosurgeons in a referral network that gives Sutter Solano electronic access to specialists. In emergencies -- stroke, aneurysm, brain tumor, or spinal injury -- a Sutter Solano physician can transmit a patient's medical scan to an on-call specialist in another location and collaborate on a quick, accurate diagnosis.
>
> Electronic Field Trips: Educational institutions, scientific research institutes, government agencies, and businesses in the Monterey area are working together to give students of all ages the opportunity to study local ecosystems close-up -- without leaving their classrooms. The project uses Pacific Bell's high-speed data services to offer interactive, electronic "field trips" to the Monterey Bay Aquarium and local research labs.
>
> Online Citizenship: In Alameda County, the public library, city police, sheriff's department, and other local agencies use Pacific Bell high-speed services to connect their community. Law enforcement agencies around the county have access to a central database of current warrants and crime analysis information. Local citizens can use public electronic kiosks to conduct business related to city or local government.

The California Web Project (CalWeb) is an effort to help schools establish home pages and to present their own projects on those pages. CalWeb is funded in part by Pacific Bell's Education First Initiative, the Pacific Telesis Foundation, and various other corporate, organizational, and individual sponsors. Projects have included, among others:[195]

- Shafer Park School, Hayward: Attractions and Points of Interest around Hayward, California
- El Dorado High School, Placerville: The Grizzly Flat Project, to help local residents analyze and renovate the local water system and develop a recreation plan
- Bass Lake Elementary School, Madera County: Business in Bass Lake.
- Victoria Elementary School, Costa Mesa: California Mission Project
- Poway High School, Poway (San Diego County): Cleaning Up Rattlesnake Creek.

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[194] From list posted at the Pacific Telesis site: http://www.pactel.com/voices/sss/sss-sol3.html.
[195] Selected from among 37 projects listed at http://al.gsn.org/calweb as of October 29, 1996.

Pacific Bell describes the Education First initiative (which helped to fund CalWeb) this way:

> In 1994, Pacific Bell launched "Education First," a $100 million project aimed at providing technology resources to the 9,000 California schools and libraries in the company's service territory. The goal of Education First is to help schools establish the telecommunications infrastructure -- ISDN lines, hardware and software -- needed to access the Internet and/or participate in videoconferencing with other sites and to help develop the skills to effectively exploit the value of interactive data and video applications . . . ISDN divides a single telephone line into three digital channels, enabling rich educational exchanges through simultaneous transmission of voice, data, faxes, images and video.[196]

Although these examples are specific to particular schools, organizations, or agencies, and are not designed for improvement of general Internet access, they do illustrate the role of corporate and individual initiative in spreading, refining, and applying the technology.

Policy Options

- **Accessibility for people with vision impairments.** Software and hardware are increasingly enabling persons with vision impairment to use the Internet, but graphics-laden Web sites may be difficult or impossible for such systems to handle. In view of the obligation to make public services and resources available to the entire public, the Legislature could require state and local government Web sites and other government-sponsored, public Internet resources to use best practices to facilitate accessibility to people with impaired vision and, as changing technology may make appropriate, to persons with other disabilities affecting their use of the Internet.

- **Public access.** As government information and services increasingly are placed online, it is important that there be widely available access to these services. For demonstration and evaluation purposes, the Legislature could consider a pilot project to test public Internet-access terminals in libraries and other appropriate places, in order to determine the costs and benefits of a system of such terminals and to evaluate potential funding methods and sources, including public, private, and commercial.

- **Rural and low-income access.** The Internet offers the potential for rural and low-income areas to have access to distant resources that might otherwise be unavailable. However, those areas must first be able to afford access and must have the necessary infrastructure of telephone lines, Internet service provider points of presence, and technical support. To encourage the timely meeting of these needs, the Legislature

[196] Condensed from summary posted at http://www.kn.pacbell.com/edfirst/. To put the $100 million figure in context, in 1995 the Pacific Telesis Group had total sales of $9.042 billion and net income of $1.048 billion.

could direct the Public Utilities Commission to prepare a plan for universal access to Internet services by a specified date.[197]

[197] The issue of extension of local exchange carrier universal service obligations to encompass Internet access is to be considered in a follow-up paper.

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California Department of Information Technology. *Interim Annual Report: Reforming the State of California's Use and Management of Information Technology.* Sacramento: the Department, July 1996. This is the first progress report issued by the new department (established January 1, 1996). The report makes note of the "explosive growth of Internet usage among state employees," and touches on electronic commerce and other issues directly and indirectly related to the Internet. The report is available from DOIT or may be found online in various formats at http://www.ca.gov/gov/doitmenu.html.

California Legislative Counsel. "A Guide for Accessing California Legislative Information on the Internet." Posted at http://www.leginfo.ca.gov. Explains the legislative process and ways of obtaining California legislative information online.

California Public Utilities Commission. Decision 95-07-050, "Rulemaking on and Investigation into the Commission's Own Motion into Universal Service and to Comply with the Mandates of Assembly Bill 3643, July 19, 1995." Posted at gopher://nic.cpuc.ca.gov.

California Public Utilities Commission. "Phone Service for Everyone: The Facts about Universal Service," August 1995. Posted at gopher://nic.cpuc.ca.gov.

California Public Utilities Commission. "Report to the Governor: A Strategy for Telecommunications Infrastructure," November 1993. Posted at gopher://nic.-cpuc.ca.gov.

Carne, E. Bryan. *Telecommunications Primer: Signals, Building Blocks and Networks.* Upper Saddle River, N.J.: Prentice Hall PTR, 1995. This book provides more information than most people probably want to know about telecommunications technology, but is a useful reference on the whole range of technical questions that arise in studying the workings of the Internet.

Casey, Chris. *The Hill on the Net: Congress Enters the Information Age.* Boston: AP Professional, 1996. This is an insider's view of how Congress moved toward the Internet.

Cheswick, William R., and Steven M. Bellovin. *Firewalls and Internet Security: Repelling the Wily Hacker.* Reading, Massachusetts: Addison-Wesley, 1994. Remarkably readable for a technical book.

Comer, Douglas E. *Computer Networks and Internetworks.* Upper Saddle River, N.J.: Prentice Hall, 1997. Admirably clear college textbook, accompanied by a CD-ROM disk featuring supplementary material. The book focuses on the hardware and software side of networks and internetworking.

Crandall, Robert W., and Harold Furchtgott-Roth. *Cable TV: Regulation or Competition?* Washington, D.C.: The Brookings Institution, 1996.

Gates, Bill. *The Road Ahead.* N.Y.: Viking, 1995. Gates is the CEO of Microsoft and one of the pioneers of the personal computer revolution. Microsoft came late to the Internet party, but when it arrived, did so with a bang.

Gillett, Sharon Eisner. "The Self-Governing Internet: Coordination by Design," prepared for Coordination and Administration of the Internet, Workshop at Kennedy School of Government, Harvard University, September 8-10, 1996. Posted at

http://ccs.mit.edu/ccswp197.html. "In this paper we have shown how the fundamental Internet Protocol is designed to create a minimally-coercive system, in which everyone benefits from collective interaction while retaining as much local choice as possible." (From the Summary and conclusion section.)

Hahn, Harley. *The Internet Yellow Pages*, Third Edition. Berkeley, California: Osborne McGraw-Hill, 1996. Although books of this type are already partly out of date before they are printed, this is nonetheless a hugely useful guide to the Internet and the Worldwide Web. If nothing else, it shows the scope of the Net's content and helps the user to at least find good starting points for information on an enormous range of topics, from the serious to the silly.

Hermans, Björn. *Intelligent Software Agents on the Internet: an inventory of currently offered functionality in the information society & a prediction of (near-) future developments.* Tilburg, The Netherlands (Tilburg University), July 9, 1996. Posted at http://www.hermans.org/agents. An up-to-date exposition of intelligent agents that appears to be a thesis, dissertation, or equivalent. An extensive annotated list of search engines is included in an appendix.

Hoffman, Donna L., Thomas P. Novak, and Patrali Chatterjee. "Commercial Scenarios for the Web: Opportunities and Challenges," JCMC, Vol. 1, No. 3. Posted at http://shum.huji.ac.il/jcmc/vol1/issue3/hoffman.html, downloaded October 10, 1996.

The Internet Unleashed. Indianapolis, IN: Sams Publishing, 1994. Massive (1387 page) anthology on every aspect of Internet. The book has relatively little (and out-of-date) coverage of the Worldwide Web, which was still emerging when it was published.

Kalakota, Ravi, and Andrew B. Whinston. *Frontiers of Electronic Commerce.* Reading, Massachusetts: Addison-Wesley, 1996. This is probably as thorough an overview of commerce on the Internet (and other forms of electronic commerce) as is in print as of this writing. It is an excellent starting point because it encompasses so much. The coverage includes all forms of electronic commerce (cable, telephone, and so on), not just the Internet, plus explanations of internetworking technology and terminology.

Klingler, Richard. *The New Information Industry: Regulatory Challenges and the First Amendment.* Washington, D.C.: The Brookings Institution, 1996.

Lemay, Laura. *Teach Yourself Web Publishing with HTML [Hypertext Markup Language].* Indianapolis, IN: Sams Publishing, 1995. Useful both as "how-to" tutorial and introduction to terminology and typical of an avalanche of self-teaching books on personal computers and computer software.

Lynch, Daniel, and Leslie Lundquist. *Digital Money: The New Era of Internet Commerce.* N.Y.: John Wiley and Sons, 1996. Uneven, but useful. Lynch is the chairman of CyberCash, Inc.

Morse, David, ed. *Cyber Dictionary: Your Guide to the Wired World.* Santa Monica, California: Knowledge Exchange, 1996. Illustrated, unusually clear dictionary of computer terms, with emphasis on networking and communications. Some terms not included in this volume are covered in Mitchell Shnier, *Dictionary of PC Hardware and Data Communications Terms.*

Negroponte, Nicholas. *Being Digital.* N.Y.: Vintage Books, 1996 (originally published in 1995). Visionary look at the future of digital communications.

Pavlik, John V. *New Media and the Information Superhighway.* Needham Heights, Mass.: Allyn & Bacon, 1996.

Rickard, Jack. "Internet Architecture," *Internet Service Providers Quarterly Directory* (published by *Boardwatch Magazine*), Summer 1996, pp. 8-21. This article is also posted online at http://www.boardwatch.com/isp/archit.htm. Page number references in footnotes to this paper are to the printed copy of posted version. This article (especially in conjunction with the rest of the directory) is the single most illuminating exposition of the physical layout of the Internet and of the manner in which access is provided, and indispensable reading for anyone trying to understand how it works.

Serim, Ferdi, and Melissa Koch. *Net Learning: Why Teachers Use the Internet.* Sebastapol, California: Songline Studios, Inc., and O'Reilly & Associates, 1996. Combines background and explanation with brief case studies of how schools, teachers, and students are using the Internet. The book comes with a CD-ROM disk that provides software and initial access to the Internet via GNN.

Shipley, Chris, and Matthew Fish. *How the World Wide Web Works.* Emeryville, California: Ziff-Davis Press, 1996. Abundantly illustrated overview of the way the Web works. Highly recommended for those who like to be shown as well as told.

Shnier, Mitchell. *Dictionary of PC Hardware and Data Communications Terms.* Sebastapol, California: O'Reilly & Associates, 1996. Wide-ranging coverage of technical terms that are often difficult to find definitions for. Some terms omitted from this volume are included in David Morse, ed., *Cyber Dictionary.*

Slatalla, Michelle, and Joshua Quittner. *Masters of Deception: The Gang that Ruled Cyberspace.* N.Y.: Harper-Collins, 1995 (HarperPerennial Edition, 1996). An alternately hilarious and amazing report of the exploits of teenage hackers at large in the telephone system. Combines insight into how the system works with an

exposé of the hacker/phone phreak ethos. (Yes, it IS spelled phreak, to correspond with phone.)

Smedinghoff, Thomas J., editor. *Online Law: The SPA's Legal Guide to Doing Business on the Internet.* Reading, Massachusetts: Addison-Wesley, 1996. A wide-ranging guide written by the attorneys of the Information Technology Law Department of McBride Baker & Coles.

Stoll, Clifford. *The Cuckoo's Egg: Tracking a Spy Through the Maze of Computer Espionage.* N.Y.: Pocket Books, 1990.

Stoll, Clifford. *Silicon Snake Oil: Second Thoughts on the Information Highway.* N.Y.: Doubleday Anchor Books edition, 1996 (originally published in 1995). Jaundiced view by a well known Internet security expert.

Tanenbaum, Andrew S. *Computer Networks*, Second Edition. Englewood Cliffs, N.J.: Prentice Hall, 1989. Highly regarded textbook covering networking and internetworking hardware and software. Predates the Internet, but provides much background.

U.S. Congress, Office of Technology Assessment. *The Technological Reshaping of Metropolitan America*, OTA-ETI-643. Washington, D.C.: U.S. Government Printing Office, 1995.

U.S. Department of the Treasury, Office of Tax Policy. *Selected Tax Policy Implications of Global Electronic Commerce*, November 1996.

Villasis, Santiago J. *An Optimal Pricing Mechanism for Internet's End-Users.* Master's Thesis (M.S. in Economics), University of Idaho, May 1996. Posted online. Copy on file with CRB.

Wright, Benjamin. *The Law of Electronic Commerce: EDI, E-mail, and Internet: Technology, Proof, and Liability*, Second Edition, with 1996 supplement. Boston: Little, Brown, 1996. The author is a member of the Texas Bar. The book (which is in loose-leaf format) covers both descriptive background and legal issues, touching on many matters not addressed at all by other sources listed in this bibliography. There is a table of cases, but no index.

In addition to the sources listed above, this paper has drawn from numerous newspaper and magazine articles (print and online), reports, commentaries, and conversations online and off.

GLOSSARY

This glossary defines selected terms used in this paper or likely to be encountered by persons learning about the Internet. There are many, many more terms The reader is referred especially to the following for a more complete list and more thorough definitions:

- Morse, David, ed. *Cyber Dictionary: Your Guide to the Wired World.* Santa Monica, California: Knowledge Exchange, 1996.

- Shnier, Mitchell. *Dictionary of PC Hardware and Data Communications Terms.* Sebastapol, California: O'Reilly & Associates, 1996.

ARCHIE. A program that allows searching of Internet sites to find files with specified keywords. Veronica, Jughead, and WAIS (wide-area information service) perform similar functions.

ASCII. American Standard Code for Information Interchange. Computer representation of plain text, in contrast to *binary*, which is the format used for executable programs and other files that are not pure text.

BACKBONE. High-capacity communication line connecting networks. All networks connected to the same backbone are thereby connected to each other, and then indirectly connected to networks connected to *those* networks.

BROWSER. A computer program designed to enable a user to view (browse among) Web sites. Prominent browsers include Netscape Navigator, Microsoft Internet Explorer, and Mosaic.

CLIENT. A computer that asks for information or services from another computer. The latter is a server.

CRACKER. A malicious or intrusive hacker.

CYBERSPACE. The world of online information and communication.

FIREWALL. A computer, with associated software, that protects an organization's computer files from unauthorized intrusion and from attacks by outsiders via communications lines. The firewall stands between the organization's internal system and the Internet.

FTP (FILE TRANSFER PROTOCOL). An Internet protocol that allows data files to be copied from one connected computer to another.

HACKER. An expert computer enthusiast; a person who enjoys programming, figuring out how programs and systems work, and experimenting with computers. Often now used in the sense of "cracker," implying malice, although the term was not originally so intended.

HIT. A visit to a site on the Internet. Advertisers like to keep count of hits to their sites in order to evaluate their effectiveness.

HOST. A computer connected to the Internet that is addressable by other connected computers and that makes data or services available on the Internet.

HYPERLINK. A reference, embedded in a document, to another document on the Internet (or to another place in the same document). A hyperlink enables the user to retrieve the referenced document or to jump to the specified location by clicking the mouse on the hyperlink. The existence and role of hyperlinks have led to the description of the Worldwide Web as a single library of linked documents distributed across the entire Internet.

INFORMATION SUPERHIGHWAY. The global information infrastructure. The term was coined before the Internet rocketed to such prominence, propelled by the Worldwide Web. Some users now virtually equate the Internet and the "Information Superhighway," as the former increasingly takes on the attributes envisioned for the former. Others, however, including Microsoft CEO Bill Gates, view the real Information Superhighway as having not yet arrived and as being something far beyond the current Internet.

INTERNET. Global network of computer networks that enables exchange of electronic mail and other types of data among all connected computers.

INTRANET. An internal corporate analog to the Internet. Intranets may be connected to the Internet via a firewall to help provide security and privacy for internal files. An intranet may use the same type of browser software and other applications as the Worldwide Web, easing use and learning for employees and helping to integrate internal and external documents and applications.

ISP (INTERNET SERVICE PROVIDER). A company that provides a connection (direct or dial-up) to the Internet. ISPs include large, national companies, such as AT&T, and numerous small local operations, as well as regional and value-added systems.

I-WAY. Another term for "Information Superhighway."

JAVA. A programming language used to enhance Web pages. Java is a product of Sun Microsystems. The language is somewhat comparable to the C and C++ programming languages, but less complicated. It allows animation and interactive features.

LOG ON (or LOGON) ID. The user's account name. For example, Joe Smith might have the log on ID *jsmith*, or *smith.joe*, or *joe.smith*, or even *programmerJoe*, depending on the system and what it permits. Log on IDs are used in conjunction with passwords to enable the user to access his or her account.

MODEM. Modulator-demodulator, a device for converting analog to digital signals, and vice versa, to mediate between a digital computer and analog (voice-grade) communications lines. The modem is the device that enables a PC to communicate with other computers over telephone lines. One modem turns the ones and zeros that computers understand into sounds that can travel over phone lines, and then another modem reverses the process at the other end of the path.

NETIQUETTE. Short for "net etiquette," unofficial but widely recognized rules of proper behavior on the Internet.

NETSCAPE. A prominent (as of this writing, also the leading) Web browser, a program that enables the Internet user to view Web pages and to move easily from one Web site to another, print pages, download files, and so on.

NEWSGROUP. A special interest discussion group on the Internet. Users may read messages and post them to the group. There are thousands of newsgroups, covering all conceivable topics, and some inconceivable ones.

ONLINE. Carried out via the Internet or other computer data telecommunications link (posted online, online conversation, and so on). Also appears as "on line" and "on-line." For consistency and because it appears now to be the preferred usage, this paper makes one word of the term: *online*, except where quoting others' different usage.

PASSWORD. The confidential string of numbers, letters, and symbols associated with a specific user's account and log on ID designed to prevent unauthorized access to the account. For example, *jsmith*'s password might be *44SCVt*34m*. Passwords are comparable to the personal identification numbers (PINs) associated with automatic teller cards, but may be more varied, as they can include upper and lower case letters, numbers, and certain symbols.

SERVER. A computer that provides information or services to client systems. A network may have many servers, for example a mail server, a file server, and a database server, among others, and of course may have many clients. On the Internet, servers house commercial, educational, and governmental sites providing information and services to clients.

SITE. A place in cyberspace. For example, Intel has a site featuring information on its products and services, www.intel.com. A "website" is a site on the Worldwide Web. The more general term "site" also encompasses Intenet sites that are not part of its graphically oriented Web aspect.

SLIP and PPP are Serial Line Interface Protocol and Point-to-Point Protocol, respectively. Both are methods for transmitting data from a PC to the Internet via a modem.

TELNET. Short for *tel*ephone *net*work, a method for connecting to a different computer on the Internet. For example, jsmith might log on to his personal account on one system, and telnet to his office account on his company's system even if the latter were thousands of miles away. He could then use the remote account while using a local communications connection.

TROJAN HORSE. A destructive program disguised as a known or useful one. Trojan horses, like viruses, may be acquired unknowingly over the Internet or other network connection or transmitted on floppy disks. ASCII text files cannot carry a Trojan horse because text files are not executed (not run as a program).

URL. Universal (or Uniform) Resource Locator, the address of a Web site. URLs take the form *http://www.goodsite.com*, for example. The first part (http, in this example, for "hypertext transfer protocol") indicates the type of resource.

USENET. "User network," the system of newsgroups on the Internet. Usenet was actually established before the Internet, running on its predecessor systems.

VERONICA. A system for searching files on the Internet.

VIRUS. A (usually) destructive program designed to propagate itself from one computer to another secretly. Some viruses are triggered by the date (set to run on, for example, Columbus Day), some are triggered by user actions (as, for example, the 100th time the user has used the "DIR" command on an MS-DOS system since the virus program appeared on the system), and some activate themselves at the first opportunity. Viruses cannot be carried in ASCII text files, but there are variants that can be carried in Microsoft Word documents.

WEB BROWSER. A computer program that enables the Internet user to view Web pages and to move easily from one Web site to another, print pages, download files, and so on.

WORLDWIDE WEB. The graphics-oriented part of the Internet.

SELECTED INTERNET SITES

> "There are some enterprises in which a careful disorderliness is the true method." (Herman Melville, *Moby Dick*, Chapter 82)

Below is a sampling of resources, selected to illustrate the range of sites already established on the Net (predominantly on the Worldwide Web) and to provide starting points for exploration.

Inclusion of a site here only to means that it is interesting and illustrative or has been useful in research, and is not necessarily an endorsement nor a determination that it is the best of its kind (although some of them may well *be* the best of their kind). Nor does exclusion of a site indicate that it is not worthwhile. The selection here does show conclusively that there is information of real value on the Internet and that it is easy to find.

Sites and URLs change, so some of those listed here may be out of date.

Books

- *Amazon Bookstore*, http://www.amazon.com, is an online bookstore with an extensive searchable catalog and offering e-mail notification of new listings on subjects the user specifies. The notification service is a small, simple example of a software agent on the Web.

- *Wiretap Online Library*, http://wiretap.spies.com, provides a large selection of public domain books, articles, and technical information in many areas. Many classics are available at this site. Navigating the site takes a little getting-used-to, although it looks much easier to navigate as a Web site than it did when it was an ftp site.

Education

The following sites pertain to education, educational resources, or educational institutions. Many of the sites listed in other sections would be useful to students and teachers, however, and some are designed specifically for educational purposes.

- *CHEERS, the California Higher Education Educational Resources System*, a site developed by the California Research Bureau, offers extensive links on and related to higher education. As of this writing, the URL for CHEERS is temporarily: http://home.sprynet.com:80/sprynet/kknutsen. It is to be transferred to the Library's Web server.

- *Distance Education* Resources, http://www.uwex.edu/disted/resources.html, offers links and information.

- *College and University Home Pages*, http://www.mit.edu:8001/people/cdemello/univ.html.

- *A Teacher's Guide to the U.S. Department of* Education, http://www.ed.gov/pubs/TeachersGuide/, is part of the Department of Education site.

- *California Schools with Web Servers*, http://www.slocs.k12.ca.us/calpage.htm.

- *Alphabetical listing of all resources mentioned by the Internet Education Clearinghouse*, http://www.unl.edu/websat/alpha.html, offers an extensive and widely varied set of links.

Ethnic and Minority

- *Afrocentric Guide to the WWW*, http://www.netlinks.net/Netlinks/AFRO.HTML.

- *Asian-American Resources*, http://www.mit.edu:8001/afs/athena.mit.edu/user/i/r/irie/www/aar.html, provides numerous links, both commercial and non-commercial.

- *Chicano!: Related World Wide Web Sites - Resources for Students*, http://www.pbs.org/chicano/weblink1.html. This site suggests grade levels for the links ("Grades 3 and up," "Grades 9 and up," etc.), making it especially useful for teachers. This is a doorway to diverse resources.

- *Ethnic and Minority Studies, MIT Libraries*, provides scores of links, many of which in turn provide further links: http://nimrod.mit.edu/depts/humanities/subjects/Ethnic.html.

- *Hispanic Heritage*, http://www.clark.net/pub/jgbustam/heritage.html, offers a wide range of links.

- *Index of Native American Resources on the Internet*, http://hanksville.phast.umass.edu/misc/NAresources.html, provides links covering many topics.

- *Judaism and Jewish Resources*, http://shamash.org/trb/judaism.html, is a diverse resource.

Government Links (Federal, State, and Local)

The sites listed below should facilitate access to virtually any government site on the Internet, directly or indirectly. Any of them provides an excellent starting point.

- *State Search*, http://www.state.ky.us/nasire/, "is a service of the National Association of State Information Resource Executives and is designed to serve as a topical clearinghouse to state government information on the Internet."

- *Villanova University Law School*, http://www.law.vill.edu/Fed-Agency/fedwebloc.html, provides numerous links.

- *Fed World*, http://www.fedworld.gov/, is an official front door to federal sites.

- *California Home Page*, http://www.ca.gov, is the official front door to California government information.

- *California State Senate home page*, http://www.senate.ca.gov, provides access to California legislative information and links to other governmental sites.

- *Thomas* (Library of Congress), http://thomas.loc.gov, gives access to Congressional documents and a starting place for other federal research.

- *State and Local Government on the* Net, http://www.piperinfo.com/piper/state/states.-html, is an excellent starting point for finding links in all states. (Note that the hyphen is not part of the URL.)

- *The White House Home Page*, http://www.whitehouse.gov/WH/Welcome.html, gives access to press releases, executive orders, and much more White House-related information, as well as links to further federal resources, such as archives of the United States Information Agency (USIA).

Internet Policy and Technology Organizations

- *The Internet Society (ISOC)*, http://ftp.isoc.org/.

- *InterNIC Registration Services*, http://rs.internic.net/rs-internic.html.

- *The North American Network Operators Group (NANOG)*, http://nic.merit.edu/routing.arbiter/NANOG/.

- *Computer Emergency Response Teams (CERT) Coordination Center (Carnegie Mellon University)*, http://www.cert.org/.

- *Internet Architecture Board (formerly Internet Activities Board), IAB*, http://www.iab.org/iab/iab.html.

- *The World Wide Web Consortium, W3C*, http://www.w3.org/pub/WWW/.

Law and Law Enforcement

- *Criminal Justice Resources on the Web*, http://www.fsu.edu/~crimdo/cj.html, includes 28 pages of links dealing with every aspect of law, law enforcement, justice, legal issues, media sources, and more.

- *General Legal Resources on the Internet*, http://www.law.georgetown.edu/-lc/internic/glr.html (the hyphen is not part of the URL), provides links to law libraries, search engines, cyberspace law resources, intellectual-property-related resources, trademark information, and other law-related sites and information.

- *The U.S. House of Representatives Internet Law Library*, http://law.house/gov, gives access to federal law and regulations.

News

In addition to the sample of general news sources listed below (most selected because of the familiarity of their print versions, especially in California), the Web has many sites for information on specialized topics, especially technology-related.

- *Los Angeles Times*, http:/www.latimes.com.

- *MSNBC*, a Microsoft-NBC collaboration, http://www.msnbc.com.

- *Nando Times*, an online news service, http://www.nando.net.

- *New York Times*, http://www.nytimes.com. This site includes "Cybertimes," a useful compendium of news and opinion related to the Internet. This site requires the user to register, but there is no charge for access.

- *Sacramento Bee*, http://www.sacbee.com.

- *San Francisco Chronicle* and *San Francisco Examiner*, http://www.sfgate.com.

- *San Jose Mercury-News*, http://www.sjmercury.com.

- *Cathy's Newsstand (Blind and Visually Impaired)*, http://www2.cdepot.net/~mist/, offers links to "speech-friendly" periodical sites, as well as information on Internet for people with sight impairments. This is also a useful list for people without impaired vision.

Also see CHEERS (listed under "Education," above) for links to many other newspapers and news sources.

Reference

- *Electric Library*, http://www.elibrary.com, a commercial site (monthly fee) offering full text of 150 newspapers, 800 magazines, thousands of (mostly public domain) books, encyclopedia, radio and television transcripts, and photo archives.

- *The Argus Clearinghouse*, http://www.clearinghouse.net/, calls itself "The Premier Internet Research Library. It describes its mission as being "a central access point for value-added topical guides which identify, describe, and evaluate Internet-based information resources . . . to facilitate intellectual access to information resources on the Internet." (Quoted from its Mission & Philosophy page.)

- *The World-Wide Web Virtual Library: Subject Catalogue*, http://www.w3.org/pub/DataSources/bySubject/Overview.html, gives a starting point for almost any Web-based research.

Religion and Culture

- *Western Religions Links*, http://weber.u.washington.edu/d36/madin/CRELIG2.HTML, provides an enormous number and range of links to sites for history and culture as well as religions *per se*. Many of the sites in turn provide further links.

- World Cultures Internet Resources, http://www.wsu.edu:8080/~dee/InternetResources.html, provides links to many historical and cultural sites, Eastern and Western alike.

- Classics at Oxford, http://units.ox.ac.uk/departments/classics/, emphasizes the Western classics.

- Classics and Mediterranean Archaeology Home Page, http://rome.classics.lsa.umich.edu/welcome.html, is another very rich site oriented to history and classics

Science

- *Scientific American*, http://www.sciam.com, provides selections from current and back issues.

- *Science* (publication of the American Association for the Advancement of Science), http://www.sciencemag.org, includes current and back issues, searchable by keyword, author, and other means. Articles often have extensive links to other resources.

- *The WWW Virtual Library*, http://www.w3.org/pub/DataSources/bySubject/-Overview.html (the hyphen is *not* part of the URL) provides links to sites covering many areas of science.

- *EurekAlert!*, http //www.eurekalert.org/, is "a comprehensive news server for up-to-date research in science, medicine, and engineering." It is a product of the American Association for the Advancement of Science, with assistance from Stanford University and Duke University.

Search Engines

There are many search engines on the Web, and appear online regularly, including "meta-search engines" that coordinate searches through multiple search engines (see, for example, http://www.search.com). Many library sites include links to search engines. A few well-known search engines are:

- *Alavista*, http://www.altavista.digital.com.

- *Lycos*, http://www.lycos.com.

- *Yahoo!*, http://www.yahoo.com. (The exclamation mark is part of the name, not my editorial endorsement.)

- *Web Crawler*, http://www.webcrawler.com.

Telecommunications and Telecommunications Policy

- *Pacific Bell Network*, http://www.pacbell.com/.

- *Telecommunications Information Resources on the Internet*, maintained by Jeff MacKie-Mason and Juan Riveros, http://www.spp.umich.edu/telecom/telecom-info.html (the hyphen is part of the URL). "This document contains references to information sources relating to the technical, economic, public policy, and social aspects of telecommunications. All forms of telecommunication, including, voice, data, video, wired, wireless, cable TV, and satellite, are included." This is the Grand Central Station of telecommunications sites.

- *Other Telecommunications Policy Issue Sites*, http://bell.com/sites.html.